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J. C. C. Jr.
CONTRIBUTIONS FROM THE
DEPARTMENT OF

ZOOLOGY AND ENTOMOLOGY

Iowa State College of Agriculture

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On the North American Species of the Subgenera Diaspidiotus
and Hemiberlesia, of the Genus Aspidiotus.

Wilmon Newell.

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Department of Zoology and
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J. C. Crawford

ON THE NORTH AMERICAN SPECIES OF THE SUBGENERA DIASPIDIOTUS AND
HEMIBERLESIA, OF THE GENUS ASPIDIOTUS.

WILMON NEWELL.

The two subgenera, *Diaspidiotus* and *Hemiberlesia*, include the majority of the North American species of *Aspidiotus*. They include, too, some of the most destructive species. Perhaps no insect of America is better known to-day than one member of this group, *A. perniciosus*.

The writer is studying this group. This paper is not presented with the assumption that it is in any sense a complete treatment of the subject. It is presented rather as a preliminary, a short summary of the present known North American species with characters of identification which it is hoped will be of some little assistance to students and others interested in these forms.

The object has been to arrange the species in the key with reference to their natural relationships. Subsequent study will doubtless show that some of the inferences drawn, are incorrect. Should this paper be the cause of the discovery of new or different relationships of any one species to any other it will have accomplished its mission.

The two subgenera considered represent a division of *Aspidiotus* specialized in a definite direction. Of *Diaspidiotus*, as Prof. Cockerell says, *A. ancylus* may be taken as the type. This subgenus is temperate in distribution and is usually characterized by small, dull colored, inconspicuous

scales. *Aspidiotus s. str.* is of course the type of the entire genus, and for the present purposes may be regarded as the most generalized. *Diaspidiotus* represents the extreme of specialization in one direction. *Hemiberlesia* is the intermediate group. Of the former, *A. osborni* and *hunteri* are of the extreme type. The resemblance to the general form is more and more marked in the various species in the order indicated in the key, until *jatrophae* and *punicae* are reached, when *punicae* presents characters such that it cannot with certainty be placed in this sub-genus or in *Hemiberlesia*. It is an intermediate form and *Diaspidiotus* grades imperceptibly into *Hemiberlesia*. Not distantly related to *punicae* is *convexus*, placed in *Hemiberlesia*, all the species of which show closer relations to *Aspidiotus s. str.* in their increased fringe of plates and the absence of chitinous processes, or their replacement by broad though thin chitinous bands. The greater number of these species are lower austral or tropical and in their distribution we see again their approach to the regular forms of the genus, i. e. *Aspidiotus s. str.*

Throughout, the characters of the female anal segment are regarded as the principal ones for classification as it has been repeatedly shown that scale characters in closely related forms are unreliable as diagnostic characters. Though valuable as specific characters in many cases, they cannot be considered as the result of relationships, but rather of environment.

To Professors Osborn, Bruner, Webster, Mally, Rolfs, Gossard, Parrott, Hunter, and others who have so kindly furnished specimens and other assistance, the author wishes to express his hearty appreciation. To Prof. Summers, of the Iowa Station, thanks are due for many valuable suggestions and assistance in the way of literature. To Prof. T. D. A. Cockerell the writer is most deeply indebted. Briefly

stated, without his assistance the preparation of the present paper would have been impossible. His kindness in corresponding, suggesting, and in loaning type specimens from his private collection, cannot be too highly spoken of.

It may also be permissible to say that the writer intends to continue the study of this interesting group, and that criticisms and suggestions will be gladly received from all. Specimens sent for identification will be promptly examined and returned except where such specimens are evidently new or rare, when a portion of the material will be retained and the remainder forwarded after being studied.

Genus* ASPIDIOTUS Bouche.

Diaspinae with female scale round or nearly so, with exuviae at or near the center. Male scales slightly elongated. Last segment of female having generally four groups of ventral glands, though these are sometimes five in number or wanting.

- A. Species in which the anal segment of the female possesses two median lobes well developed; second and third lobes only partially developed or rudimentary.
- B. Female anal segment with incisions having markedly thickened edges; plates small or spine-like. Most species with scale small or dark colored. Occurring on deciduous trees in the northern part of the temperate zone.....Subg. *Diaspidiotus*.
- BB. Female anal segment with marked incisions but with chitinous processes thin, or replaced by a broad chitinous band; segment usually with a dense fringe of plates, these often multi-branched. Occurring for the most part in the lower austral and tropical zones.....Subg. *Hemiberlesia*.

Subgenus DIASPIDIOTUS (Berl. and Leon.) Ckll.

- A. Female anal segment with plates short and simple, or absent, not forming a marked fringe.

*A summary of the principal subgenera of the genus is given in a bulletin by Prof. Cockerell, Tech. Ser. No. 6, Div. Ent. U. S. Dept. Agr.

- B.* With second lobe entirely rudimentary.
- C.* Median lobes erect, produced, no notch on inner margin, incisions even, chitinous processes small and even. *osborni*.
- CC.* Median lobes usually notched on both sides, interval between first and second lobes wide, inner process of first incision larger than outer. *ancylus*.
- BB.* Second lobe slightly developed.
- C.* Outer chitinous process of first incision largest. *hunteri*.
- *CC.* Inner chitinous process slightly the largest.
- D.* Median lobes invariably notched on both outer and inner margins.
- E.* Median glands always absent.
- F.* Caudolateral and cephalolateral groups distinctly separated. Cephalolaterals, six to seven; caudolaterals, three to four. *howardi*
- FF.* Cephalolateral and caudolateral groups merged together in a line or but very slightly separated. Cephalolaterals and caudolaterals together, eleven to fifteen; caudolaterals when separable, about nine. *coloratus*
- EE.* Median glands, none to two; cephalolaterals, four to nine; caudolaterals, three to eight. *uvae*.
- DD.* Median lobes never notched on inner margin, median group of glands absent. *aesculi*
- CCC.* Inner chitinous process first incision much elongated, enlarged at apex. *subsimilis*
- BBB.* Second lobe with inner angle decidedly developed.
- C.* Median lobes normal in length, usually more or less notched on outer margin.
- D.* Inner chitinous process of first incision twisted or club-shaped. *forbesi*
- DD.* Inner chitinous process of first incision not club-shaped, both processes of very nearly equal size.
- E.* Ventral grouped glands absent. *pernicius*.
- EE.* Ventral grouped glands present.
- F.* Chitinous processes of first incision long and about equal; caudolateral glands less than five; medians exceeding six. *ostreaeformis*

*Under this head belongs presumably *A. townsendi* Ckll. It has been impossible to obtain specimens of this species for study and the available description, which will be found word for word on a subsequent page, is not sufficiently diagnostic to place this species with certainty in its proper place. According to Prof. Cockerell it is closely related to *uvae*.

- FF. Inner process largest; caudolaterals exceed five, medians less than six..... *fernaldi*
- CC. Median lobes low and broad, scarcely if at all notched on outer margin.
 - D. With five groups ventral glands..... *juglans-regiae*
 - DD. Grouped glands absent.
 - E. Chitinous processes of first incision equal; or outer one the largest..... *coniferarum*.
 - EE. Inner chitinous process of first incision much the largest..... *cueroensis*.
- AA. Plates often, all or some of them, complex, more numerous and forming a considerable fringe to anal segment.
 - B. With second and third lobes slightly developed.
 - C. Apices of second and third lobes irregular; many-pointed semi-circular plates between lobes 2 and 3..... *comstocki*.
 - CC. Second and third lobes coming to definite points at inner angles; at least two definite complex, but elongated, plates between lobes 2 and 3..... *jatrophae*
- BB. Second lobes slightly developed, third lobes rudimentary.
 - C. Ventral grouped glands present..... *punicae*.
 - CC. Ventral grouped glands absent..... *diffinis* var. *lateralis*.*

ASPIDIOTUS OSBORNI Newell and Ckll.

Newell and Cockerell, Coccidae of Iowa by Osborn, Iowa Acad. Sciences, Vol. V., p. 229. Des Moines, Iowa, 1898.

Since the original description was written additional material has come to hand and better apparatus for the re-examination of the type specimens has been available. The re-examination has made a few changes in the original description necessary. In the language of that description the word "spine" should be read in place of the word "plate." A few minor differences will also be noted in the following description:

Female scale dark, very nearly color of bark of host, not

*Unfortunately specimens of ~~and~~ *A. diffinis* var. *lateralis* are not at hand for examination. However, as Prof. Cockerell speaks of the presence of ventral grouped glands as being an uncertain character for some species (Can. Ent. Vol. 25, p. 130), it would seem that since both *punicae* and the var. *lateralis* have the form of the lobes identical (second lobe slightly developed, third rudimentary) he would have allowed the latter to have remained a variety of *punicae* where he first placed it instead of placing it as a variety of *diffinis*, which in the typical form has all three lobes developed.

unlike the scale of *A. obscurus* Comst. in general appearance; diameter 1 to 1.25 mm., subovate, about 1-7 longer than wide; exuviae rather large, sub-marginal, appearing dark brown when on host, yellowish orange under microscope when detached from insect; ventral scale a mere white film. Male scale longer and narrower; same color as female scale; exuviae near cephalic end.

Median lobes ultimate ventral segment of female well developed, long, narrow, apex rounded, notched on outer side, broadened below notch to base; rudiment of second lobe with margin slightly doubly concave, the degree varying in different individuals; margin of third lobe rudiment even; a notch in margin a short distance laterad of second incision, a marked concavity of the margin still laterad of this and separated from it by a convexity; margin laterad of this markedly serrate. Median incision not reaching to base of lobes; second and third incisions comparatively deep and narrow; two cavities in body wall, adjoining anal margin, one just mesad of marginal notch, the other mesad of marked concavity, with slightly thickened margins which in weak light make them appear as incisions. A large ovate chitinous process at inner base of median lobe; chitinous processes of second incision about equal; processes of third incision about uniform in thickness and smaller than those of second incision. A pair of spines from the outer base of median lobe, a pair of spines from rudiment of second lobe, a pair from third, one small spine from each of cavities near margin, sometimes one or two more along margin, and usually a spine from lateral edges of each penultimate and antepenultimate segments. Ventral grouped glands: cephalolaterals, five to seven; caudolaterals, three or four, medians usually none, but sometimes two.

The position of the notches and concavities of the anal

margin is rather variable so that these characters are of specific value only in connection with others.

Specimens received from Prof. Hunter, collected at Lawrence, Kan., from *Quercus alba* differ only in having the second and third incisions apparently a little longer and narrower.

This species was originally described from specimens collected from white oak (*Quercus alba*) at Ames, Iowa. Specimens have been received from Lawrence, Kan., on the same host, and Prof. T. D. A. Cockerell has reported the occurrence of this species in Georgia. It has been taken also at Ames from ironwood (*Ostrya Virginica*).

ASPIDIOTUS ANCYLUS Putnam.

Diaspis ancylus. Putnam J. D., Trans. Ia. Hort. Soc., Vol. XII, p. 321. 1877.

Aspidiotus ancylus. Putnam, Proc. Davenport Academy Natural Sciences, Vol. II, p. 346. Davenport, Iowa, 1880.

Female scale round, 5-6 mm. to 1 mm. in diameter; male scale longer, about 5-6 mm. wide by $1\frac{1}{3}$ mm. long. Both male and female scale same color, varying with host, dark on maple or apple, gray when upon white bark of birch, on some hosts wood beneath the scale turned to a pinkish color; exuviae orange red.

First pair of lobes of ultimate ventral segment of female well developed, slightly separated, interior edges sub-parallel, outer edges notched about three-fourths distance from base to apex, interior edge usually plainly notched just below apex, sides of notches straight, meeting at an angle of approximately 90 degrees, apex sub-truncate with corners rounded; second pair lobes not extended beyond anal margin, apex not markedly rounding, more nearly truncate, wide; third lobe rudimentary, rudiment truncate. Incision between first and second lobes wide, about equal in width at base and apex,

incision between second and third lobes similar; a very small incision in anal margin laterad of second incision at a distance slightly exceeding width of second lobe. A small chitinous process on interior base median lobe, sometimes a very small one on exterior base median lobe; a well defined chitinous process mesad of first incision and adjoining the latter, a slightly smaller one on exterior edge of same; small chitinous process on interior edge of second incision, outside edge of second incision with narrow chitinous margin. A pair of spines just outside base of median lobe, not exceeding median lobe in length, one member of the pair being situated on dorsal side of the body and the other on the ventral; one pair spines from each the second and third rudimentary lobes, about equaling median lobe in length, one member of each pair dorsally situated as in first pair; other spines, few in number often on anal margin laterad of third lobe. Plates, simple, di-pointed or with side prongs, located one pair each in first and second incisions and one or two laterad of third lobe. Median group of spinnerets usually four or five in number, sometimes absent; caudolaterals, four to eight; cephalolaterals, six to fourteen.

In this as in most of the species the two halves of the anal segment are rarely exactly alike, but the variation from the specific character is not likely to be sufficient to cause confusion. In the case of spines and plates that are variable mention is not made, nor are they figured.

This species has been taken at Ames, on birch, black maple, plum and snowball.

ASPIDIOTUS ANCYLUS var. *SERRATUS* N. and Ckll.

Newell and Ckll., Coccidae of Iowa by Osborn, Ia. Acad Sc., Vol. V, p. 229,

This variety presents a few well marked differences as

compared with *ancylus* proper. The scale is smaller, female scale about 4-5 of a mm. in diameter and much darker. The scales do not cluster, as is often the case with *ancylus*, never more than two or three being found even close to each other. This variety occurs on willow, the individuals usually being found on the tough bark of the small limbs and are practically undetectable without a lens.

The median lobes are more truncate than in *ancylus* proper and have their ends minutely serrate. The chitinous processes of the first incision are about equal.

This variation seems to be one which does not bear directly toward any other species, no *Diaspidiotus* being known, having the ends of the lobes serrate. The variation from the specific form is not more than in many species is frequently encountered without being classed as a distinct variety. In the latter cases however the variation is unconstant, while in the present case the variation is found to be uniform, and always the same, constituting a distinct variety.

ASPIDIOTUS ANCYLUS Putn. var. LATILOBIS Newell.

Newell, W., Can. Ent. Vol. XXXI.

Scale similar to that of *A. ancylus*.

Median lobes of female wide and flaring, without notch on inner margin; outer marginal notch frequently obtuse or nearly wanting; radial structure at base of median lobes on dorsal surface especially prominent. Second lobe rudimentary, slightly convex; third lobe as in *ancylus*. Inner chitinous process of second incision slightly larger than outer; chitinous processes on base of median lobes larger and more marked. Ventral grouped glands as in *ancylus*. Dorsal pores very prominent.

Male: Length, exclusive of antennae, 1 to 1 1-6 mm.; width of body, 1-4 to 1-3 mm.; spread of wings, $1\frac{1}{4}$ mm.; length

of antenna, 6-10 mm.; general color of body light yellow, eyes very dark purple.

Habitat: Mountain ash (*Pyrus americana*) at Ames, Iowa.

ASPIDIOTUS HUNTERI n. sp.

Female scale round, light gray in color, 1 3-4 to 2 1-4 mm. in diameter, intermediate in size between scales of *ancylus* and *juglans-regiae*: portion immediately surrounding exuviae dark; exuviae sublateral in position, dark orange in color.

Female anal segment with median lobes broad and slightly notched on outer margin, sometimes with several notches; second lobe with inner angle slightly produced; third* lobe entirely rudimentary. A simple plate between median lobes, a small, multi-pointed plate laterad of median lobe and two laterad of second lobe. A pair of spines from each first, second and third lobes, and one from lateral margin. Small chitinous process on outer base of median lobe; outer process of first incision always the largest; outer process of second incision nearly obsolete. Ventral grouped glands: median, none to five; cephalolateral, six to ten; caudolaterals, seven to eleven.

Described from thirteen females and numerous scales on currant imported to Alton, Iowa, from Texas in 1897.

To S. J. Hunter, of the University of Kansas, this species is respectfully dedicated.

Types in the collection of the Ia. Exp. Stat. and in the National Museum.

ASPIDIOTUS HOWARDI Ckll.

Cockerell, T. D. A., Can. Ent. Vol. XXVII, p. 16. Jan. 1895.

Scale of female round, 1 1-2 mm. in diameter, gray; exuviae sublateral, dark orange in color.

Median lobe well developed, notched on outer margin, with often indication of indentation on inner margin; second lobe very slightly developed, inner angle longest; third lobe rudimentary. First incision considerably deeper than second. Inner chitinous process of first incision largest. Plates about five in number, small, branched, and distributed between median lobe and outer part of rudimentary third lobe. Dorsal glands conspicuous. Ventral grouped glands: median, none; cephalolateral, six to seven; caudolateral, three to four.

Habitat: Plums at Canon City, Col., and Albuquerque, N. Mex. (Cockerell and Gillette.)

ASPIDIOTUS COLORATUS Ckll.

Aspidiotus urae Comst. var. *coloratus*. Cockerell. T. D. A., Psyche, Vol. VI, p. 571.

Aspidiotus coloratus. Cockerell, Bul. Div. Ent. U. S. Dept. Agr. Tech. Ser. No. 6, p. 20.

Scale pale orange brown, oval, about 1 1-2 mm. in diameter, very slightly if at all convex; exuviae comparatively large, subcentral, slightly darker than surrounding scale, covered.

Anal segment of mature female with median lobes well developed, parallel, not rounding, distinctly notched on both outer and inner margins; second lobe with inner angle developed; third lobe rudimentary. Plates small and inconspicuous. Incisions marked. Chitinous processes of incisions not nearly so strong as in *ancytus*; inner chitinous process of first incision larger than outer; chitinous processes of second incision reduced to a fine line bordering margins of incision. Ventral grouped glands: median, none; cephalolateral, seven to eight; caudolateral, six to nine; cephalolateral and caudolateral groups usually merged together, glands arranged lineally, or groups separated by a very slight interval.

Immature female with three lobes present.

Habitat: On *Chilopsis*, Las Cruces, N. Mex. (Ckll.)

The form of the second lobe of the adult closely resembles the form of the second lobe of *howardi*, and somewhat less, the second lobe of *ancylus*. The resemblance to *howardi* is noticed in a number of other features. Hence it seems not improbable that the immature form of *howardi* has similarly all three lobes.

ASPIDIOTUS UVAE Comst.

Comstock, Rep. U. S. Dept. Agr. 1880, p. 308.

Scale nearly round, brownish yellow, perceptibly lighter than bark of host; diameter about 1 1-2 mm., exuviae sub-central. Male scale about 1 1-5 mm. long by 1-2 mm. wide.

Female anal segment: Median lobes notched on both outer and inner margins, parallel, long; second lobes little more than rudimentary, apex rounding or slightly convex; rudiment of third lobe slightly raised at inner angle. Two chitinous processes bounding each of the second and third incisions, the inner processes in each case slightly the largest. Two plates with short side branches laterad of median lobe and three laterad of second lobe; four simple plates laterad of third lobe. A pair of spines from each first, second and third lobes, and a pair on lateral margin.

Parasitic on grapevine in Indiana (Comstock) and in Kansas (Parrott).

Hunter in his "Coccidae of Kansas"* describes a variety of this species occurring on *Carya alba* at Lawrence, Kan., but does not name it. The scale is described as reddish white and the scales are found occurring promiscuously, instead of being arranged in rows as are the scales of typical *uvae*. The body of the female is lemon yellow with deep orange spots, these predominating along the caudal margin of

*Kan. Univ. Quarterly, Vol. VIII, p. 4. Jan. 1899.

the penultimate segment. Plates forked, two laterad of each incision.

ASPIDIOTUS AESCULI Johns.

Johnson, W. G., Bull. Ill. State Lab. Nat. Hist., Vol. IV. pp. 386-88. 1896.

Female scale circular, about 2 1-2 mm. in diameter, dirty gray, with exuviae subcentral, orange red.

Female anal segment with median lobes well developed, often slightly notched or indented on outer margin, not notched on inner margin; second lobes slightly developed on inner angle; third lobes practically obsolete. First incision marked; second incision no more than an inward curve of margin. Inner chitinous process of first incision slightly largest.* Plates simple, one just laterad of median lobe and two between inner angles of second and third rudimentary lobes. A pair of spines from each median, second and third lobes and one from lateral margin. Ventral grouped glands; median, none; cephalolateral, five to seventeen; caudolateral, four to eleven. Curious club shaped thickenings are present, around which the glands are grouped.

Habitat: Buckeye, *Aesculus californica*, at Stanford University, Cal. (Johnson.)

ASPIDIOTUS AESCULI Johns. sub. sp. SOLUS Hunter.†

Hunter, S. J., Kan. Univ. Quarterly, Vol. VIII, p. 12. Jan. 1899.

Scale circular, 2 1-2 to 3 mm. in diameter, dark gray, much darker in center than at margin; exuviae subcentral, dark in color.

The female anal segment differs materially from that of *aesculi*. Median lobes similar to those of *aesculi*. Two

*Specimens of this species have not been obtainable for examination. However as Prof. Johnson's description says nothing of chitinous processes around second incision and as they are not figured, it is to be inferred that they are absent.

†This form differs so materially from *aesculi* that it seems as if its characters might almost be considered of specific importance.

marked incisions each side, varying little in size, each of which is bordered by a definite pair of chitinous processes. A forked plate and simple plate laterad of median lobe, one to three simple plates between first and second incisions, and one or more simple plates laterad of second incision. Median glands are occasionally present but not exceeding three in number. Cephalolateral glands, nine to fourteen; caudolateral glands, six to nine.

Habitat: Walnut, *Juglans nigra*, at Lawrence, Kan., (Hunter.)

ASPIDIOTUS SUBSIMILIS Ckll

Cockerell, T. D. A., Am. Mag. Nat. Hist., p. 168. Feb. 1899.

Female anal segment with median lobes rather long, rounding; rudiment of second lobe usually slightly doubly concave; rudiment of third lobe co-extensive with lateral margin. Median incision very shallow; second and third incisions also shallow. Two small chitinous processes on the base of median lobe; inner process of first incision much elongated, enlarged at apex, club-shaped, outer chitinous process shorter and only slightly enlarged; processes of second incision about equal. A pair of spines from each second and third lobes and a simple spine at about the middle of lateral margin; probably also a pair of spines from median lobes. Ventral grouped glands absent. Plates not detectable in the six type specimens examined.

Habitat: Cuantla, Mex.

This appears to be a very distinct and peculiarly characterized species, especially in the nature of the chitinous processes.

ASPIDIOTUS FORBESI Johns.

Johnson, W. G., Bul. Ill. State Lab. Nat. Hist., Vol. IV, p. 380.

Female scale round or only slightly longer than wide,

diameter 1 1-2 to 2 mm.; exuviae sub-central or central, yellowish orange in color; margins of scales of both sexes grayish and flaky. Male scale oblong ovate, about 2-3 mm. by 1 mm., exuviae near cephalic end, same color as in female scale.

*Body of female insect circular or oblong, 3-4 mm. to 4-5 mm. long. In much dried specimens the margins of the penultimate and antepenultimate segments are drawn back until even with the anal margin, giving the body much the form of *A. reniformis*, a coincidence however that cannot be considered as any more than purely accidental.

First pair of lobes of ultimate ventral segment of female well developed, approximate at apex, rounded, acutely notched on outside about one-third distance from apex to base; second lobe with mesal half well developed, longitudinal axis of interior half parallel to longitudinal axis of median lobe; third lobe rudimentary. Incision between mesal lobes well rounded at its apex; incision between first and second lobes well marked, widest at apex; incision between second and third lobes slightly smaller; margin outside of third lobe often minutely crenate. A small chitinous process at inner base of median lobe, smaller one at outer base; large club-shaped process mesad of and adjoining first incision, small process on outer margin; chitinous curved process around second incision often broken at apex of incision so as to appear as two separate processes, one on each side of the incision. A pair of spines outside base of median lobe, a pair from each second and third lobe and one or two on

*The writer has not been able to detect any definite structures that may be designated as plates, nor do they appear to be mentioned in any of the papers already published upon this species. However on the anal margin, outside the third lobe, there appear in several of the specimens examined, "short stubs" similar to but thicker than the bases of the spines. These appear very much like the rudiments of plates. Their absence in many of the specimens can doubtless be attributed to their destruction in preparation of the specimen, it being difficult to so prepare a specimen as to preserve the plates in good condition.

margin laterad of second incision. All ventral grouped glands located well forward, numbered as follows: median, two; cephalolaterals, three to eight; caudolaterals, three to five.

This species was originally described from Ill. where it has in some localities become a serious pest. It has been received from Douglas Co., Kan., and has been collected at Ames on plum.

ASPIDIOTUS PERNICIOUS Comst.*

Comstock, J. H., Rep. U. S. Dept. Ag., 1880, p. 304.

Female scale circular, dark grayish, 1 1-4 to 2 mm. in diameter; exuviae central, somewhat yellowish, not so distinctly orange as that of *forbesi*. Male scale oblong.

Median lobes of female anal segment prominent, length and width about equal, distinctly notched on outer margin; second lobe long, equaling about half of median lobe in length, inner angle decidedly developed, pointed, one or more (usually two) small notches on outer margin; third lobe rudimentary. Incisions between median and second lobes, and between second and third lobes marked. A small chitinous process on inner margin of median lobe; a well defined process each side of first incision, the inner one slightly the largest; chitinous processes of second incision small but distinct, about equal. Spines small, from median, second and third lobes. Plates small and simple, usually a distinct pair on rudiment of third lobe and from eight to ten smaller inconspicuous ones laterad of these. Ventral grouped glands absent.

*There are so many papers and bulletins available at the present time upon this, the San Jose scale, and its habits that it is not thought necessary to give here more than a diagnostic description. Some of the articles referred to will be found as follows: Cockerell, Bul. No. 6, Tech. Ser., Div. Ent., Dept. Agr.; Howard, Scale Insects of the Orchard, Yearbook Dept. Agr. 1894, p. 267; Insect Life, Vol. VII, No. 4; Starnes, Bul. 36, Ga. Exp. Sta.; Howard and Marlatt, Bul. No. 3, N. Ser. Div. Ent., U. S. Dept. Agr.; Gould, Buls. 144 and 155, Corn. Univ. Exp. Sta., Ithaca, N. Y.; Webster, Buls. 81 and 103, O. Exp. Sta., Wooster, Ohio; Hunter, Kan. Univ. Quart. Jan. 1899.

Habitat: Cosmopolitan, capable of infesting practically any deciduous tree or shrub. It is known to thrive and to withstand the severity of the winters as far north as St. Paul, Minn. (Lugger.)

Though very closely related to *forbesi* and less so to *ancylus*, this species was doubtless originally introduced from Japan, as trees imported direct from that country have been found by Prof. Webster* infested with this species. Mr. Craw, the quarantine officer at San Francisco, Cal. has also found *perniciosus* upon trees received at that port from Japan†

ASPIDIOTUS OSTREAEFORMIS Curt.

Aspidiotus ostreaeformis Ruricola (Curtis). Gardener's Chronicle. 1843. p. 803.

Aspidiotus circularis Fitch. An. Rep. N. Y. St. Ag. Soc. 1856. p. 426.

Diaspis ostreaeformis, Comstock. Rep. U. S. Dept. Ag. 1880. p. 311.

Aspidiotus ostreaeformis Curtis. Douglas. Ent. Mo. Mag., Vol. XXIII. p. 239.

Female scale dark gray, about 1 mm. in diameter; exuviae very large, yellowish, sub-marginal in position.

Body of female yellow to dark brown, nearly round; anal segment more acute than in most of the native American species.

Anal segment of female with median lobes well developed, broad; second lobes developed on inner halves, not exceeding one half length of median lobes, diminishing in length by a rough margin to outer angle; third lobe rudimentary. Two small plates between median lobes; two small plates with side branches between first and second lobes; and one plate between second and third lobes. A pair of spines from each first, second and third lobes, and one spine on lateral margin one-third distance to penultimate segment. Mere trace of chitinous process on inner margin of

*Can. Ent. Vol. XXX, p. 170. July, 1898; Bul. 103, O. Exp. Sta p. 196. March, 1898.

†Cockerell, Ent. News., Vol. IX, pp. 95-96.

median lobe; two long, well marked processes adjoining shallow first incision; two smaller processes at sides of second incision. Ventral grouped glands situated well forward, coudolateral groups opposite the vaginal orifice: median, six to seven; cephalolateral, nine to eleven; caudolateral, eight to nine.

This is an English species, imported into the U. S. It has been reported from Almeda, Cal.* and has recently been received at the Dept. of Agr. from several points in the country (Cockerell).

This species does not appear to assume any definite place with relation to American forms. It is doubtless representative of a European group, corresponding to the American group of *forbesi*, *ancylus*, *perniciosus*, etc.

ASPIDIOTUS FERNALDI Ckll.

Cockerell, T. D. A., Am. Mag. Nat. Hist., Oct. 1898, p. 323,

Scale very similar to that of *A. ancylus*.

Female anal segment: Median lobes wide, sometimes slightly notched on outer margin; second lobes well produced on inner angle, margin in same line with margin of median lobe, often indented one to four times; third lobe slightly raised on inner angle. Small chitinous process on inner base of median lobe; inner process of first incision very large, outer one small; crescentic process around second incision. Plates small and spine-like, one or two between median lobes, two between median and second lobes, and about three laterad of middle of second lobe. A pair of spines from each pair of lobes and one from lateral margin. Ventral grouped glands: median, two to six; cephalolateral, five to twelve; caudolateral, about five to seven.

Habitat: Boston, Mass., on *Gleditschia tricanthos*

*Cockerell, p. 8, Bul. Div. Ent. U. S. Dept. Agr. Tech. Ser. No. 6.

(Cooley). Also on Juneberry at Manhattan, Kan. (Parrott).*

ASPIDIOTUS FERNALDI Ckll. sub. sp. ALBIVENTER Hunter.

A. fernaldi Ckll. sub. sp. *cockerelli*. Parrott, Can. Ent. Vol. XXXI, p. 10, Jan. 1899.

A. fernaldi Ckll. sub. sp. *albiventer*. Hunter, Kan. Univ. Quarterly, Vol. VIII, p. 6, Jan. 1899.

“Scale 1 1-2 to 2 mm in diameter, round; exuviae sub-central, orange red, covered by a white secretion.”

An examination of a number of specimens of this form received through the kindness of Mr. Hunter, show it to differ from *A. fernaldi* in the following characters: Inner chitinous processes of first incision more nearly equal, but inner one always largest; median lobes apparently more notched; second lobes smaller and with more of a tendency to indenting on outer margin; two pairs of spines from second lobe instead of one. Mr. Hunter gives the glands as follows: median, two to six; cephalolateral, ten to twelve; caudolateral, five to eight.

Habitat: Maple, at Lawrence, Kan. (Hunter) and at Manhattan, Kan. (Parrott).

†ASPIDIOTUS JUGLANS-REGIAE Comst.

Comstock, J. H., Rep. U. S. Dept. Agr. 1880, p. 300.

Female scale white or light gray, approximately round, 2 mm. in diameter. Exuviae covered by a thin film, dark orange when uncovered, large, sub-marginal in position. Male scale smaller, oblong, about 1 1-3 mm. in length, exuviae near cephalic end.

Median lobes of ultimate segment of female well devel-

*According to Parrott the insects occurring on Juneberry vary considerably but differ in no tangible character from *fernaldi*.

†S. J. Hunter in Kan. Univ. Quarterly, Vol. VIII, p. 9, Jan. 1899, describes a variety of this species but gives it no name. Its principal differential characters may be summarized as follows: Second lobe with three notches on lateral margin; a chain-like incision extending cephalad from each incision. Ventral grouped glands: median, three to five; cephalolaterals, nine to eleven; caudolaterals, nine to ten.

oped, broad, close together, inner corners well defined, apex broad and rounding, or minutely serrate; second lobe inner half reaching nearly to outer angle of median lobe, with two distinct notches and often one additional smaller notch on outer margin; third lobe rudimentary, often raised to an angle at outside of second incision; margin outside second incision uneven or with angular projections. Median incision narrow, not reaching to base of median lobes; first incision with mouth narrow, caused by inclination, towards median line, of the second lobe; second incision well marked. A small chitinous process at inner base median lobe; chitinous process at inner margin of first incision very large, curved, a smaller process at outer edge of first incision; two small plates between first and second incision; second incision surrounded by a ring of chitin, thickest at inner margin and sometimes broken at the apex to appear as two processes. The spines of the first, second and third lobes are rather blunt at their apex. A pair of spines on outer base of each median lobe, one spine ventral and the other dorsal, barely exceeding length of median lobe; a pair of spines from second lobe, one ventral and the other dorsal; a pair from third lobe similarly situated; sharp pointed, a spine about one-fourth, and a long sharp one about one-half the distance to penultimate segment. A small plate at outer base of median lobe, and another, spine-like, usually with one fork, on outer margin of second lobe. Ventral grouped glands: median, none to four; cephalolaterals, six to sixteen; caudolaterals, four to eight.

ASPIDIOTUS JUGLANS-REGIAE Comst. var. ALBUS Ckll.

Cockerell, T. D. A., Can. Ent. Vol. XXVI. p. 132. May, 1894.

Female scale flat, 2 1-2 mm. in diameter, white; exuviae orange red, covered with white secretion.

Female anal segment with four rows of orifices (*A. juglans-regiae* has but three—Riley). Plates and spines inconspicuous. Ventral grouped glands: median, one; cephalolateral, nine; caudolateral, ten.

Habitat: Pear at Mesilla, N. Mex (Cockerell).

ASPIDIOTUS JUGLANS-REGIA Comst. var. PRUNI Ckll.

Cockerell, T. D. A., Can. Ent. Vol. XXVI, p. 132. May, 1894.

Female scale 2 1-2 mm in diameter, brown; exuviae covered by a fine secretion which when rubbed off shows the exuviae orange.

"Female anal segment with median lobes large and blunt, close together, notched on outer margin, second lobes smaller, notched on outside; third lobes obsolete." Spine-like plates at intervals along margin. Ventral grouped glands: median, one; cephalolateral, six or seven; caudolateral, five to seven (Cockerell).

Habitat: Plum, Las Cruces, N. Mex. (Townsend).

ASPIDIOTUS CONIFERARUM Ckll.

Cockerell, T. D. A., Psyche, Vol. VIII, No. 264, p. 201, April, 1898.

Female scale 1 1-3 mm. in diameter, circular, white, rather convex; exuviae sub-central, reddish brown in color.

Female anal segment with median lobes large, low and broad; second lobe low and broad; third lobe rounded. Incisions marked; chitinous processes pyriform, large; outer process of first incision largest. Two small plates between median lobes and three small ones between median and second lobes; three behind second lobe.

Habitat: Pine, Organ Mts., N. Mex.

ASPIDIOTUS CUEROENSIS Ckll.

Cockerell, Can. Ent. Vol. XXXI, p. 105. May, 1899.

Female scale slightly exceeding 1 mm. in diameter,

grayish white, slightly convex, margins slightly raised; exuviae sub-central, inconspicuous, covered.

Median lobes of female low and broad, contiguous at base, diverging; second lobe low but slightly developed at inner angle; third lobe rounding, scarcely exceeding margin. Incisions marked, surrounded by pyriform chitinous processes; inner process of first incision decidedly the largest. Plates apparently absent in specimens examined. A spine from each lobe and a pair on lateral margin. Dorsal glands few, circular. Ventral grouped glands absent.

Habitat: *Celtis*, Cuero, Texas. (Townsend.)

ASPIDIOTUS COMSTOCKI Johns.

Johnson, W. G., Bul. Ill. State Lab. Nat. Hist., Vol. IV, p. 383.

Female scale nearly circular, varying in shape with position on host plant, 1 1-2 to 2 mm. in diameter, cream buff in color, exuviae sub-marginal, covered, appearing yellowish or reddish brown, sometimes not differing materially in color from remainder of scale. Male scale same color as body of female scale, oval, measuring 1-2 by 1 mm.

Female anal segment with median lobes well developed, usually notched on both margins; second lobes developed, sometimes equaling median lobes in size, irregular in outline; third lobe much smaller but distinct, outline irregular. Toothed plates between median and second lobes; a broad semi-circular fringe (figured as a single plate by Johnson) between second and third lobes; three smaller plates, forked from two to four times, laterad of third lobe. Ventral grouped glands: median, none; cephalolaterals, about six; caudolaterals, about four.

Habitat: Sugar maple, *Acer saccharinum*, in Ill. and New York. (Johnson),

ASPIDIOTUS JATROPHAE Towns and Ckll.

Townsend and Cockerell, Journ. N. Y. Ent. Soc. Sept. 1898, p. 178.

Body of female round, yellow. Median lobes of anal segment well developed, close together, notched on outer side; second lobe with inner part acutely produced to about opposite middle of median lobe, usually distinctly notched at apex, outer portion roundly sloping to second incision; third lobe slightly developed at inner angle. Median incision narrow; first and second incisions rather small and shallow. A chitinous process on each side of first incision, the inner the largest and with apical angle often produced making the latter appear superficially as a third process, outer process enlarged toward apex; second incision with two chitinous processes, small, of nearly equal size. Between median and second lobes, one or two multi-pointed plates; between second and third lobes two slender plates and a broad multi-pointed one; laterad of third lobe three plates, the inner one broadest and most complex. Ventral grouped glands absent.

ASPIDIOTUS JATROPHAE Towns. and Ckll. var. PARROTTI n. var.

This form differs from the preceding in the following characters: Scale smaller, quite convex; exuviae lateral. Inner portion of second lobe broader and shorter than in *jatrophae*, distinctly notched; inner portion of second lobe longer. Chitinous processes of first incision about equal; two processes on base of median lobe much more pronounced.

Described from six females in the collection of Prof. Cockerell, collected from "*Barenjeno Chiquito*" at Frontera, Mex. (Div. Ent. 7825).

Named in honor of Prof. P. J. Parrott of the Kansas Agricultural College, in recognition of the useful studies he has recently made of certain of the Coccidae.

ASPIDIOTUS PUNICAE Ckll.

Cockerell, T. D. A., Jn. Inst. Jamaica, 1893, p. 225.

Female scale approximately circular, 1 to 1.4 mm. in diameter, white; exuviae orange brown.

Female anal segment with median lobes large, plainly notched on outer margin, slightly notched on inner margin near end; second lobes small, inner angle prominent, roundly sloping to apex of second incision; third lobe rudimentary, "practically obsolete;" margin laterad of third lobe slightly serrate. One or two small plates between median lobes and many simple spine-like plates between median and third lobes. A spine from each of first, second and third lobes, and one from lateral margin. Chitinous processes of first incision wide, rounding, inner one largest; chitin of second incision pronounced but hardly separable into two processes. Ventral grouped glands well forward, caudolateral group opposite vaginal orifice; median, one; cephalolateral, five to six; caudolateral, two to three.

Habitat: Pomegranate in Jamaica and cocoanut in Dominica.

This form, as before mentioned, shows a distinct approach to the species of *Hemiberlesia* in the form of the chitinous processes and the fringe of plates. Indeed the general resemblance to *A. cydoniae* is quite marked, but the number and shape of the plates are materially different.

ASPIDIOTUS DIFFINIS Newst. var. LATERALIS Ckll.

Cockerell, T. D. A., Can. Ent. Vol. XXVI, p. 130.

Female scale 1 mm in diameter, brownish white to brown, convex, round or slightly oval; exuviae subcentral, "Female with lobes and plates as in *punicae*." Ventral grouped glands absent.

(See note on p. 5 relative to this species.)

Subgenus *HEMIBERLESIA** Ckll.

- A.* Grouped glands present.
 - B.* Median lobes parallel or close together.
 - C.* Plates short, simple, with not over three branches, *convexus*.
 - CC.* Plates long and complex, some plates with at least four branches.
 - D.* Second, fourth and fifth plates from median lobes wide and many branched, first and third narrow with small side branches, two or three small simple plates laterad of third lobe,.....*cydoniae*
 - DD.* First and second plates from median lobes wide and multi-pointed; third, fourth and fifth simple and narrow,.....*aracii*.
 - BB.* Median lobes far apart, second and third lobes small but distinct,.....*palmae*.
- AA.* Grouped glands absent.
 - B.* Anal segment of female with normal angle of acuteness; median lobes with breadth and length equal, or latter the greatest.
 - C.* Median lobes notched on both outer and inner margins.
 - D.* Median lobes broad, inner chitinous process of first incision considerably the largest,.....*ulmi*.
 - DD.* Median lobes longer, chitinous processes of first incision equal,.....*rapax*.
 - CC.* Median lobes with margins straight, parallel, not notched, apices slightly rounding, corners prominent,.....*tricolor*.
 - BB.* Anal segment shortened in an antero-posterior direction so as to appear obtuse or blunted, broader than long; median lobes broader than long,.....*cupressi*.

ASPIDIOTUS CONVEXUS Comst.

Comstock, J. H., Rep. U. S. Dept. Agr. 1880, p. 295.

Scale similar to that of *rapax* but more opaque.

Female anal segment with median lobes broad, notched on both margins; second lobe nearly obsolete, third entirely so. First and second incisions surrounded by chitinous bands, approximately uniform in width. Plates short, about

**Aspidiotus bigeloriae* Ckll., described from *Bigeloria brachylepis*, Los Angeles, Cal., is placed in this subgenus by Cockerell. However its characters are so different from those of the remaining species that the writer prefers to omit it from the table until its position is determined with certainty. It does not appear to be a *Hemiberlesia*. See Bul. Div. Ent. Tech. Ser. No. 6, p. 20.

two complex ones caudad of each incision and three to six simpler ones laterad of third lobe. Ventral grouped glands: median, none; cephalolateral, seven; caudolateral, four to five.

Habitat: Native willows in California (Comstock).

ASPIDIOTUS CYDONIAE Comst.

Aspidiotus cydoniae. Comstock, Rep. Dept. Agr. 1880, p. 295.

**Aspidiotus greeni*. Cockerell, Bul. Div. Ent., Dept. Agr. Tech. Ser. No. 6, p. 12.

Female scale round, translucent, resembling scale of *A. rapax*, from 1 to 1.1-3 mm. in diameter; exuviae black as seen from ventral side, orange under microscope with strong light. Male scale same color, 1.1-6 mm. long by 1-2 mm. wide; exuviae prominent, same color as exuviae of female scale.

Body of female round, yellow. Anal segment with median lobes well developed, notched on both inner and outer margins, outer notch more cephalad than inner; second lobe rudiment wide, slightly raised at inner angle; third lobe similar to second. A small chitinous process at inner base of median lobe and usually one at outer base. A chitinous process each side of first incision, the inner one the largest; a well developed chitinous ring around second incision. Two spine like plates between median lobes; between median and middle of rudimentary third lobe, five plates about equaling median lobe in length, all with three or more forks or branches, the second, fourth and fifth wide and much forked, the first and third narrower with small side branches; on outer portion of rudimentary third lobe two smaller simple plates; one simple plate on margin about one-third distance from third lobe to penultimate segment. A pair of spines from

*On the authority of Prof. Cockerell. See remarks upon this species at location cited. It seems Green sent specimens of *A. cydoniae*, labeled as *A. cyanophylli* by mistake, to Prof. Cockerell who described them as *greeni*.

each lobe and a pair from lateral margin midway between second incision and penultimate segment. Ventral grouped glands: median, none; cephalolateral, three to nine; caudolateral, one to seven.

Comstock in the original description gives the number of glands as eight to nine for the cephalolateral and five to seven for the caudolateral groups. Specimens in Prof. Cockerell's collection from Frontera, Mex., have three glands in each of the caudolateral and from five to seven in the cephalolateral, while specimens received from Prof. Gossard, Lake City, Fla., have from one to three in the caudolateral and three to four in the cephalolateral groups. It will be seen that the various specimens present a gradation from the lowest numbers given to those given in the original description. In all other respects they accord perfectly with Prof. Comstock's figures.

ASPIDIOTUS CRAWII Ckll.

Cockerell, Bul. Div. Ent., U. S. Dept. Agr., Tech. Ser. No. 6, p. 9.

Female scale circular, 2 mm. in diameter, convex, dull reddish gray; exuviae sublateral, inconspicuous with exception of the first skin which shows as a yellow prominence.

Female anal segment with median lobes long and close together, each lobe notched on both inner and outer margins, outside margin of lobe straight below notch; rudiment of second lobe wide, often notched; rudiment of third lobe slightly raised at inner angle. Median incision narrow, edges straight; second and third incisions small. A small chitinous process at outer base of median lobe; a broad chitinous band surrounding each second and third incisions, either band sometimes, but very rarely, divided at apex of incision so as appear as two processes. Two plates with numerous branches just laterad of median lobe; about three plates, simple and long, on rudiments of second and third lobes. A pair of

spines from each lobe and a spine on lateral margin one-third distance to penultimate segment. Ventral grouped glands forward, caudolateral group about opposite vaginal orifice: median, none; cephalolateral, five; caudolateral, four

Originally described from specimens taken in Mexico.

This species closely resembles *cydoniac*. Perhaps it is really no more than a variety of it. At the same time there is no question but that it is distinctly different from the form described as *cydoniac* by Comstock, both in the size and color of the scale and in the characters of the plates of the anal segment.

ASPIDIOTUS PALMAE Morg. and Ckll.

Morgan and Cockerell, Ent. Mag., Vol. XXIX, pp. 40 and 80.

Specimens and the original description are not at hand. The following is from Cockerell's description in Bulletin Tech. Ser. 6 of the Division of Entomology.

Female scale much like that of *rapax*. Female differs from *rapax* by the distinct though small second and third lobes, median lobes wider apart, plates longer and much branched at the tips, four groups of ventral glands.

Habitat: West Indies, on cocoanut and banana, and rarely on other plants.

ASPIDIOTUS ULMI Johns.

Johnson, W. G., Ill. State Lab. Nat. Hist., Vol. IV, p. 388.

Female scale circular, diameter 1-2 mm, whitish; exuviae orange colored, sub-central in position.

Median lobes of female anal segment parallel, notched distinctly on both sides; second and third lobes rudimentary. Inner chitinous process of first incision elongated and enlarged into a knob at its apex, extending well forward. All plates spine-like; two between median and second lobes; four between first and second incisions; and three or four laterad of

third lobe. A pair of spines from each lobe and one from lateral margin. Ventral grouped glands wanting.

Habitat: White elm, *Ulmus americana*, at Urbana, Ill., (Johnson) and catalpa at Lawrence, Kan. (Hunter).

ASPIDIOTUS RAPAX Comst

Comstock, J. H., Rep. U. S. Dept. Agr. 1880, p. 307.

Scale gray, yellowish when covering living female, convex, diameter 1 1-2 mm.; exuviae sub-central, covered, appearing brownish or black.

Female anal segment with median lobes long, notched on both sides, outer notch most prominent; second and third lobes rudimentary. Incisions deep, bordered by chitinous bands of nearly uniform width throughout. A pair of spines on each first, second and third lobes and a pair on lateral margin about one-fourth distance from third lobe to penultimate segment. A pair of simple plates between median lobes; two multi-pointed plates opposite each incision; a simple one on rudiment of second lobe; and two or three laterad of second incision. Ventral grouped glands absent.

This species was named the greedy scale by Prof. Comstock on account of its infesting a large number of different plants. In his work on scale insects (See Ag. Rep. 1880) he gives the following hosts: almond, quince, fig, willow, eucalyptus, acacia and locust. In addition to these Coquillett* gives the following: apple, pear, Myosporium, birch, English laurel, maple, South African silver tree, *Rhamnus*, Cal., walnut, holly, fuchsia, cottonwood, camellia, orange and lemon. In North America this species is found principally in the lower austral and northern tropical zones. It is not uncommon in the southern states and in California and in the northern states is occasionally found on greenhouse plants. It has been taken upon *Osmanthus* at Ames, Iowa.

*Yearbook, Dept. Agr., 1894, p. 262.

ASPIDIOTUS TRICOLOR Ckll.

Cockerell, Can. Ent. Vol. XXIX, p. 266.

Female scale circular, slightly convex, 1 1-3 mm. in diameter, white; exuviae sub-lateral or central, first skin black, second dark orange.

Female anal segment with median lobes approximately rectangular, large; inner margins straight, parallel to outer ones and to each other; outer and inner corners equal, strong; ends slightly rounding; second and third lobes obsolete. Incision between median and obsolete second lobe narrow, bordered by chitinous processes; second incision small. Two spine-like plates between median lobes, laterad of median lobes five serrate and three short spine-like plates. Ventral grouped glands absent.

Habitat: Salina Cruz, Mex.

ASPIDIOTUS CUPRESSI Ckll.

Cockerell, T. D. A., Am. Mag. Nat. Hist., Feb. 1899, p. 168.

Body of female oblong. Anal segment broad, posterior angle comparatively obtuse. Median lobes broad, somewhat irregular in outline, short; second and third lobes entirely rudimentary, rudiments even in outline. Median incision shallow, broad, sides straight; second and third incisions rounding. Chitinous processes absent; lateral edges of first incision slightly thickened; inner edge of second incision similarly thickened. A pair of broad di-pointed plates occupying median incision; a broad plate caudad of first incision and one arising from same; three simple plates from rudiment of second lobe; one, usually di-pointed, and three simple spine-like plates laterad of second incision. All plates short, not exceeding median lobes in length. No spines visible on specimens examined. Ventral grouped glands absent.

This form cannot be regarded as a distinct connecting link between *tricolor* and *Aspidiotus* s. str. as its position at the end of the table might indicate. It is rather a divergent form, decidedly different from any other in the subgenus.

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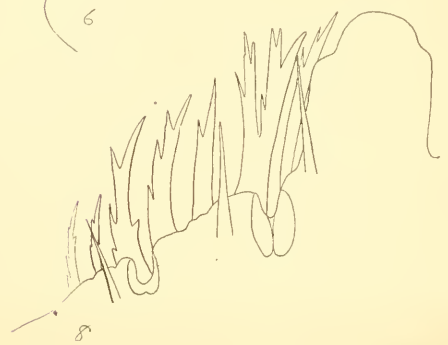
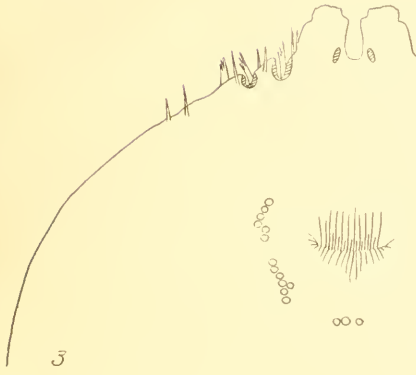
Since the foregoing pages were printed, type specimens of *A. hunteri* and *A. ancylus* var. *latilobis* have been examined by Mr. C. L. Marlatt of the U. S. Dept. of Agr. He regards *hunteri* as identical with *ostreacformis*, and does not recognize the var. *latilobis* as possessing characters distinguishing it from *ancylus* proper.

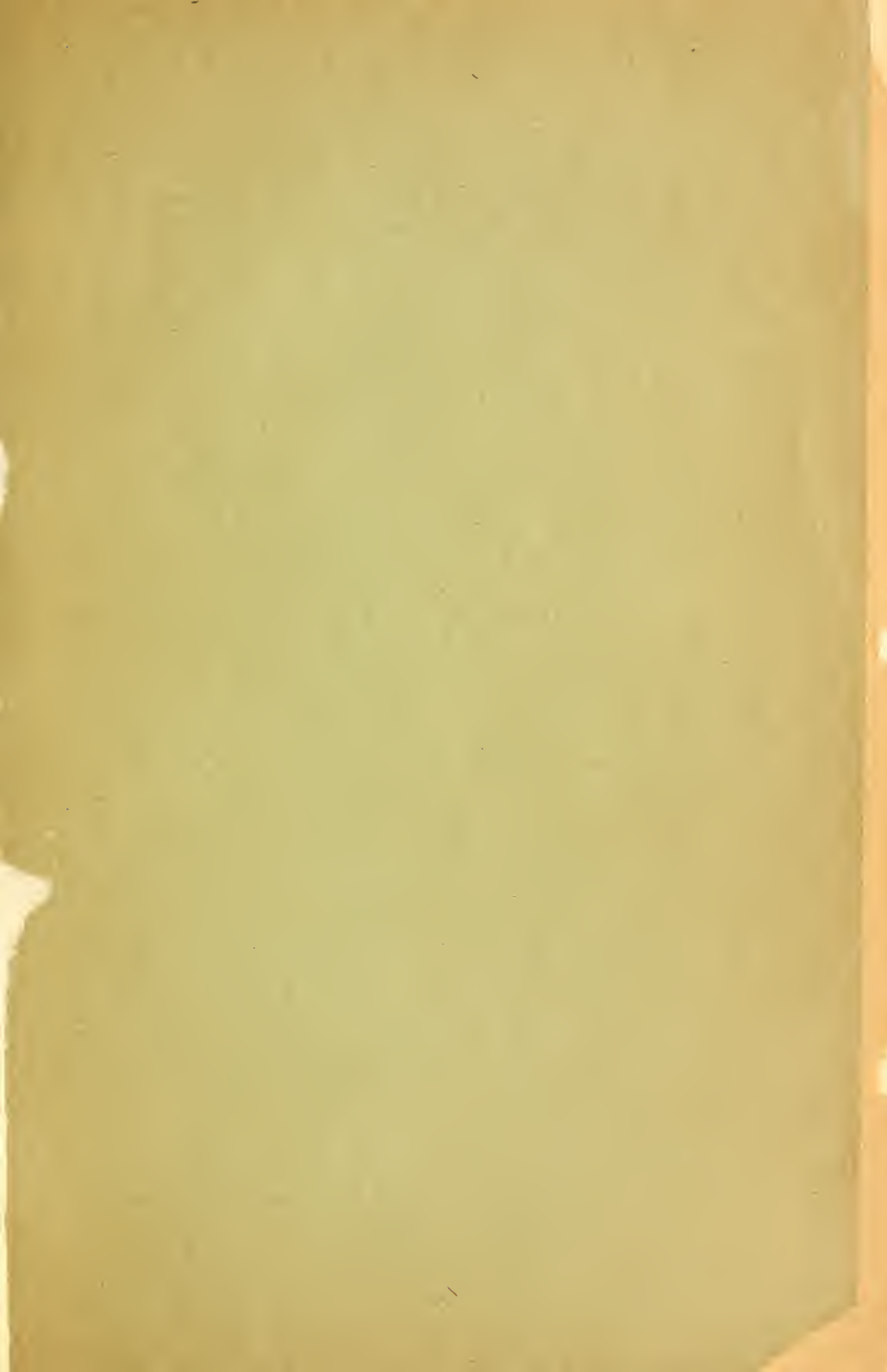
E. Earnest Green, in a communication to the writer, states that in all probability *A. cydoniae* is a synonym of *A. lataniae* Sign. Prof. Green's conclusions are based upon a study of the type specimens of the latter species in the Vienna Museum. The results of his study will appear in a coming number of the Entomologist's Magazine.

Ames, Iowa, July 15, 1899.

EXPLANATION OF PLATE .

- Fig. 1. *Aspidiotus osborni* N. and Ckll.
Fig. 2. *Aspidiotus hunteri* n. sp.
Fig. 3. *Aspidiotus ancylus* Putn., var. *serratus* N. and Ckll.
Fig. 4. *Aspidiotus ancylus* Putn., var. *latilobis* Newell.
Fig. 5. *Aspidiotus jatrophae* Towns. and Ckll.
Fig. 6. *Aspidiotus jatrophae* Towns. and Ckll., var. *parrotti* n. var.
Fig. 7. *Aspidiotus crawii* Ckll.
Fig. 8. *Aspidiotus cydoniae* Comst. (Through a mistake the shading of the chitinous processes in this drawing was omitted. They should be shaded precisely the same as are the processes of *crawii*.)





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CONTRIBUTIONS FROM THE
DEPARTMENT OF

ZOOLOGY AND ENTOMOLOGY

Iowa State College of Agriculture

„AND,,

Mechanic Arts.

NUMBER 3.

Notes on Coccidæ occurring in Iowa. Herbert Osborn.

On the occurrence of the White Ant (*Termes flavipes*) in Iowa. Herbert Osborn.

Additions to the List of Hemiptera of Iowa with descriptions of new species.
Herbert Osborn.

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Contributions from the
of Zoology and Entomology

NOTES ON COCCIDÆ OCCURRING IN IOWA.

HERBERT OSBORN.

Aside from the interest attaching to this family of the Homoptera as a remarkably specialized group of insects, the fact that it includes some of the most destructive insects affecting woody plants, and that one member of the family, the San Jose scale, is at present spreading rapidly throughout the eastern United States, and a most serious menace to the fruit interests of Iowa, is sufficient reason for giving it a special notice at this time. It seems also unnecessary to apologize for including in this article some matter for the use of teachers, students, and others who may be called upon to examine scale insects in connection with the popular interest that is bound to appear with the further extension of the San Jose scale.

The Coccidæ in general are scale-like insects that with few exceptions become permanently fixed to the bark upon which they occur. The females once fixed never leave the point of attachment unless it be to move from leaf to twig for winter security, but the males undergo a very marked transformation and appear as delicate bodied creatures with one pair of wings.

In a few cases as with the mealy bugs, attachment is not permanent and no scale is formed, while of the scaled forms there are two distinct types, the shield or armored scales (Diaspinæ), having a separated waxy scale, and the unarmored scales (Lecaninæ), having the waxy secretion not separated from the body.

Our state fauna includes representatives of all the sub-families, and in an enumeration of the species we can point out the characteristics and give such details of generic structure as will be of service to those specially interested.

A number of the records given here are based upon specimens collected by Mr. Wilmon Newell.

COCCINÆ.

In this sub-family the adults are usually active and remain distinctly segmented through life, but in *Kermes* they become fixed. The body terminates in a pair of lobes, bearing bristles, and there are no anal plates.

In *Orthezia* the body is covered with calcareous plates of very regular pattern, while in *Dactylopius* there is a waxy secretion of a mealy appearance, easily detached, but usually forming quite definite marginal appendages on each segment.

Kermes differs from both these in losing the segmentation of the body in the adult females, the body becoming globular, gall like, and attached by a narrow ventral line.

Orthezia americana Walk.

The insect referred to this species has been noted at Ames in considerable numbers on one or two occasions, but it must be generally scarce. The genus to which it belongs is peculiar in that the secretion from the body wall forms long parallel filaments or lobes, completely hiding the insect, and is calcareous in composition.

Dactylopius longispinus Targ.

The common mealy bug of greenhouses, while not indigenous, is so fully established everywhere that it must be recognized as belonging to our fauna. It is about five mm. long, oval in form and covered with a white mealy powder. The long thread-like appendages extending backward separate it from the following species.

Dactylopius citri Rossi.

This species is found occurring in the greenhouse at Ames, on *Dieffenbachia* and foliage plants. It is easily separated from the preceding by the short marginal appendages.

Dactylopius trifolii Forbes.

A species found here on clover some years ago, but of which no perfect specimens for determination were available, may quite certainly be referred to the form described from the same plant by Professor Forbes. It has never been observed in great abundance and probably does not rank as a very destructive species.

The *D. sorghiella* of Forbes in all probability will be found also in Iowa.

Kermes galliformis Riley.

The striking resemblance of these scales to the galls occurring on oak leaves is sufficient to deceive the expert as well as the uninitiated. Taken from oak, on the under surface of the leaves and upon the twigs, at Ames.

LECANINÆ.

The members of this sub-family are with few exceptions permanently attached as adult females: the anal opening is covered with two small lobes, the scale is formed of a waxy secretion and is not separated from the body, and the legs and antennæ are retained in the adults.

Lecanium hesperidum.

This widely distributed and abundant species is familiar to all who keep oleanders, and it occurs also on a long list of other plants, but mostly greenhouse species. Its greasy brown oval scale is very conspicuous and cannot fail to attract attention. It is about three mm. long. It is stated that the male has never been found, although the species has been studied from the time of Linnæus down.

Lecanium hemisphaericum Targioni.

Another greenhouse pest occurring on oranges, palms, and various plants. It is much more convex, approaching hemispherical. It is about 3.5 mm. long and three wide.

Lecanium oleæ Bernard.

This species has been taken on *Ficus* and *Naphitum litschii*, in the greenhouse at Ames.

Pulvinaria innumerabilis Rathvon.

This has been definitely recorded for a number of localities in Iowa, and it at times becomes so abundant as to prove a veritable pest. The monograph of the species by J. Duncan Putnam, of Davenport, is a most elaborate and valuable study and the basis of much that is known concerning the habits and life histories of these puzzling insects.

Specimens referred to this species have been taken from basswood the past summer.

DIASPINÆ—THE ARMORED SCALES.

In this group the adult females are permanently fixed and covered by a scale separate from the body and formed by the exuviae and waxy secretions from the dorsal surface. The legs and antennæ become useless and much aborted, while the anal segment is specialized and furnishes the most important structural characters,—visible only with the compound microscope.

Parlatoria ziziphe Lucas.

I have on one occasion secured specimens of this species from lemon bought in the market at Ames*. It occurs in enormous abundance on the orange in the vicinity of Naples, Italy, and the fruit, branches, and leaves exposed in the Naples markets are often loaded with the scales. Its black color and the quadrangular form of the scale are striking characteristics that enable one to recognize it at a glance.

Mytilaspis pomorum Bouche.

This, the "Oyster Shell Bark Louse," which attracted much attention some twenty to twenty-five years ago, and which for many years caused great havoc in the orchards of the state, is still to be met with in many orchards but in most cases in rather limited numbers. At present it occurs in considerable abundance on certain lilac bushes at Ames.

Various agencies appear to hold it in check during most of the time, and its recognition and subjection present no such serious problem as confronts us in the case of *perniciosus*.

Mytilaspis citricola Pack.

This can scarcely be called a member of our fauna, as its occurrence in the state is dependent on its attachment to oranges and lemons that come into our markets. Its frequent appearance in this manner is, however, sufficient reason for its mention here, and it may easily occur on trees in greenhouses, as do a number of tropical Coccids that have now a world wide distribution.

Chionaspis salicis Linn.

The white glistening scales of this species, often covering the branches of willows, makes it a very conspicuous species. It is

*This is possibly from imported fruit, as I know of no records of the occurrence of the species on trees in this country.

abundant at Ames and doubtless occurs generally over the state where willows are grown.

Chionaspis ortholobis Comst.

Taken by Mr. Newell on cottonwood at Ames. It resembles the preceding species but is shorter and broader.

Chionaspis pinifolia Fitch.

This species, which is common on pine and spruce, and which has been received from Davenport and has been collected at other points along the Mississippi, has never been seen at Ames, a fact which shows very strikingly the limited powers of unaided distribution possessed by these insects and the great importance of preventing the transportation of infested trees. The scale is slender and white, closely fitting the narrow leaves on which it occurs.

Chionaspis furfurus Fitch.

This is probably the most generally distributed and injurious scale insect infesting orchards in Iowa at the present time. The female scale is flattened, broadly oval or rounded, and the exuviae at one end, and the male scale is narrow, white, with three carinae, one central and one at each side. The eggs remain under the scale during the winter and hatch about the first of June.

Diaspis rose.

Specimens of this species were received from Muscatine in 1896, and a record made in the last volume of the Academy. It has been received from Davenport also. It is not apparently distributed over the state, but it thrives on a variety of plants as well as the roses, and its dispersal should be prevented as far as practicable. Like many other species it is often mistaken for *pernicosus*, but its white color, larger scale, and position of the exuviae will enable a careful observer to distinguish it by means of the scales alone.

Diaspis cacti Comst.

The various members of the cactus family are infested with this species, and greenhouses may usually be depended upon to furnish a supply. Mention of this species was made in 1882, since which Professor Comstock has given it a technical description.

Aspidiotus ancylus.

Originally described from specimens taken at Davenport, this species has attracted little attention until within a few years, when the close resemblance of its scale to that of the San Jose has made it well known. It is very small and usually too few in numbers and scattered to attract attention. Mr. Newell has recently collected it at Ames from maple, cherry, plum, and birch, and it evidently has a general distribution in the state.

Aspidiotus ancylus var *serratus* Newell and Cockerell n var.

This occurs very sparsely on native willows. The scale of the female is small, less than one mm. in diameter, and dark grayish, the same color as the bark of the host.

This form differs materially from *ancylus* proper in the following characters: Median lobes more truncate and minutely serrate at end. The glandular thickenings of the first interlobular interval are about equal.

A very small and obscure variety that is difficult to detect, but which is of little economic importance.

Aspidiotus forbesi Johns

This species has been collected at Des Moines and at Ames and doubtless has a general distribution through the state, although its minute size and usually scant numbers seldom bring it to notice. It is one of the most closely related to the San Jose scale, and without close microscopic study is separated only with great difficulty. It occurs on cherry, apple, crab, ash, and a number of other plants.

Aspidiotus osborni Newell and Cockerell n sp.

Scale of female small, oval, 1 to 1.25 mm. in length by $\frac{1}{2}$ to $\frac{3}{4}$ mm. in breadth, irregularly margined, dark, spotted minutely, and of a general scurfy appearance; exuvia dark brown, submarginal, small; scale of immature female more elongate and frequently curved to one side; ventral scale a mere white film.

Body of female circular, last segment yellow. Ultimate ventral segment: median lobes well developed, close together, produced, comparatively long and narrow, erect, scarcely or not at all notched on the inner side near end, but well notched about half way down on the outer side, ends sometimes minutely serrate; second and third lobes wanting; two incisions present, the glandular thickenings of the first incision long, about equal, well apart, outer straight, the inner nearly so, glandular thickenings of the outer incision like those of the first, a small thickened process just laterad of apex of first incision; plates spine-like, about equal in length to median lobe, often angularly curved near apex, situated, one

laterad mesal lobe, two laterad first incision, two just laterad of second incision, and one about one-third the distance from the second incision to penultimate segment, and several smaller plates irregularly placed on anal margin: edges of penultimate and antepenultimate segments usually provided each with a spine-like plate; ventral-grouped glands, cephalolateral about seven, caudolaterals three or four, median none.

This species is closely allied to *A. ancylus* Putn., but differs in the character of the scale, the median lobes are narrower and more produced and lack the well defined inner notch, and the number of the ventral glands is different. In *ancylus* the inner thickening of the first incision is decidedly larger than the outer, in marked contrast to the nearly equal thickenings of *osborni*. Described from sixteen females and numerous scales collected from white oak at Ames, Iowa.

Aspidiotus juglans-regiae Comst.

This species is common in more southern localities and has been observed in Iowa for the first time during the present season. It was received from Alton, Sioux county, where it occurred in great abundance on currant bushes and was thought possibly to be the San Jose. It was introduced from Texas, but evidently thrives in its present habitat. It may easily prove a serious pest, but has never been considered as approaching *perniciosus* in destructiveness. It is a much larger species than *perniciosus*, the scale being about three mm. in diameter, so that it may be easily recognized without microscopical examination even.

Aspidiotus nerii Bouche.

A very common and at times a very destructive species, but fortunately not spreading to any extent upon native plants. It is particularly inimical to the Oleander and it is not uncommon to see these plants completely encrusted with the white circular scales. I have received specimens from Des Moines and it has been taken on *Cycas revoluta* in the greenhouse at Ames.

Aspidiotus ficus Riley Mss.

On *Ficus unica*, and *Ficus* sp in the greenhouse at Ames. A very similar species, if not identical with this, also occurs on *Daphne odorata*, but on account of their being parasitized, good specimens for determination were not available.

Aspidiotus rapax Comst.

This species occurs on *Osmanthus* and other plants in the greenhouse at Ames. This species is abundant and destructive

on a great variety of plants, but has never proved troublesome to native plants outside the lower austral zone.

While the San Jose scale has not as yet been received from any point in Iowa we can hardly hope to remain exempt from its attacks. It is of the utmost importance to recognize it at once in case it appears in any locality. The scale is circular and the exuviae form a nipple-like elevation at or very near the center. No eggs will be found under the scales, as the females produce living young, and a microscopic examination of the last segment of the female shows an absence of the grouped ventral glands common to related species. All scales, however, that can not be referred certainly to some of the above named species had best be sent at once to the experiment station or referred to some one thoroughly acquainted with the characters by which it is recognized.

ON THE OCCURRENCE OF THE WHITE ANT (*TERMES FLAVIPES*) IN IOWA.

BY HERBERT OSBORN.

I am not aware of any published record of the occurrence of *Termes flavipes* in Iowa and aside from a note book record by J. Duncan Putnam I have not until the present year been able to secure any definite facts that would warrant listing it as belonging to our fauna.

Last year Mr. F. M. Rolfs stated in one of my classes that he had seen this species at his home in Le Claire in Scott county, and when he returned to the college from his summer vacation this year he brought with him a number of examples of the workers and soldiers collected at that place.

The well known habits of this insect and the great economic importance it sometimes assumes where it gets access to stored books or documents, or to the timbers of bridges and buildings, render this definite occurrence of sufficient interest to record.

In all probability the species occurs throughout the timbered portions of the state, adjacent to the Mississippi at least. I think it hardly possible that it can occur at Ames, as I have examined thousands of old stumps and logs in quest of insects and have never yet met with it there.

ADDITIONS TO THE LIST OF HEMIPTERA OF IOWA,
WITH DESCRIPTIONS OF NEW SPECIES.

BY HERBERT OSBORN.

A number of additions to the Hemipterous fauna of the state have been made during the last year, either by collection or by the determination or description of specimens previously in hand, and although there are certainly many others to add it seems desirable to record such as have come to notice. In many cases the record greatly extends the range of the species as heretofore known.

HETEROPTERA.

FAMILY SCUTELLERIDÆ.

Homœmus œneifrons Say. Rare, three specimens, Ames.

Homœmus bijugis Uhler. Ames, Little Rock.

FAMILY CYDNIDÆ.

Geotomus sp.

FAMILY PENTATOMIDÆ.

Perillus circumcinctus Stal. One specimen, Sioux City, July 7, 1897.

Mecidea longula Stal. One specimen, Sioux City, July 5, 1897.

Trichopepla atricornis Stal. Little Rock and Ames.

Peribalus piceus Dallas. Two specimens, Little Rock. Collected by E. D. Ball.

Holocostethus abbreviatus Uhl. One specimen, Ames. Easily confused with *Peribalus limbolarius*.

Banasa dimidiata Say. Ames, not common.

FAMILY COREIDÆ.

Chariesterus antennator Fab. One specimen, Sioux City, July 5, 1897.

- Catorhintha mendica* Stal. Ames.
Harmostes reflexulus Say. Ames and Sioux City.
Aufeius impressicollis Stal. Ames.
Corizus lateralis Say. Ames.
Daycoris humilis Uhl. Little Rock. Collected by Mr. Ball.

FAMILY LYGÆIDÆ.

- Pamera vicina* Dallas. Ames, Little Rock.
Rhyparochromus floralis Uhl. Ames.
Scolopostehus affinis Uhl.

FAMILY CAPSIDÆ.

- Teratocoris discolor* Uhl. Ames and Little Rock. Rare.
Pallacocoris suavis Reut. Sioux City.
Lopidea strigta Uhl. Ames.
Lopidea fuscicornis Uhl. Little Rock.
Lopidea nigrida Uhl. Ames.
Lomatopleura cesar Reut. Ames, Little Rock, Sioux City, Cherokee.
Hadronema pulverulenta Uhl. Ames.
Phytocoris eximius Reut.
Phytocoris puella Reut.
Phytocoris puella var.
Phytocoris sp.
Melinna fasciata Uhl. Ames. Common in 1897.
Melinna modesta Uhl. Common at Ames, 1896 and 1897.
Largidea opaca Uhl. var.
Fulvius anthocoroides Stal. One specimen, Ames, August 6, 1897.
Mimoceps gracilis Uhl. Ames and Little Rock.
Sthenarops malinus Uhl. Ames. Common.
Macrolophus separatus Uhl. Ames.
Episcopus ornatus Reut. Ames and Des Moines.
Plagiognathus obscurus Uhl. Ames.
Coquillettia mimetica n sp. Ames.
Sericophanes ocellatus Reut. Dimorphic female, ant like.

FAMILY TINGITIDÆ.

- Leptostyla oblonga* Say. Ames. Common,

FAMILY ARADIDÆ.

- Neuroctenus simplex* Uhl. Ames. October 11, 1897. On grass far from timber.

FAMILY NABIDÆ.

Coriscus annulatus Reut. Ames.

SALDIDÆ.

Salda deplanta Uhl. Ames. Plentiful during 1897.

Salda ligata Say. Le Claire. (J. A. Rofs.)

HOMOPTERA

FAMILY BYTHOSCOPIDÆ.

Macropsis apicalis O. & B. Ames.

Pediopsis trimaculata Fh. Ames.

Pediopsis basalis V. D. Ames.

Pediopsis bifasciata V. D. Ames.

Pediopsis ferruginoides V. D. Ames.

Pediopsis suturalis O. & B. Ames.

Pediopsis erythrocephalus G. & B. Ames.

Pediopsis gleditschiæ O. & B. Ames. Very common on honey locust.

Pediopsis reversalis O. & B. Ames. Very common on willow

Agallia uhleri V. D. Sioux City, July 7, 1897.

Agallia cinerea O. & B. Sioux City and Little Rock in July.

Idiocerus pallidus Fh. Ames.

Idiocerus duzeii Prov. Ames.

Idiocerus brunneus O. & B. Ames.

Idiocerus snowi G. & B. Ames.

Idiocerus moniliferæ O. & B. Ames.

FAMILY TETTIGONIDÆ.

Gypona pectoralis Spang. Ames. Rather common.

Gypona cinerea Uhl. One specimen collected at Little Rock,

FAMILY JASSIDÆ.

Dorycephalus vanduzeei O. & B. At Little Rock. Collected by E. D. Ball.

Parabolacratichus flavidus Sign. (?). One specimen, Audubon (Ball).

Paramesus stramineus n. sp. Ames, Sioux City, and Little Rock.

Deltocephalus imputans O. & B. Ames.

Deltocephalus obtectus O. & B. Ames.

Deltocephalus cruciatus O. & B. Ames.

Deltocephalus collinus Dahlb. Little Rock and Sioux City. July.

- Scaphoideus ochraceus* n. sp.* Ames.
Scaphoideus picturatus n. sp. Burlington.
Lonatura catalina O. & B.† Ames, Sioux City, Burlington.
Lonatura megalopa O. & B. Little Rock.
Driotura robusta O. & B. Sioux City, July 7, and Little Rock.
Athysanus anthracinus V. D. Ames.
Athysanus parallelus V. D. Ames.
Athysanus osborni V. D. Ames.
Athysanus punctatus O. & B. Ames and Little Rock.
Eutettix scaber O. & B. Ames.
Eutettix cincta‡ O. & B. Ames.
Eutettix modesta O. & B. Ames.
Phlepsius lobatus n. sp. Ames and Little Rock.
Thamnotettix cyperaceus n. sp. Ames.
Thamnotettix ciliata n. sp. Ames.
Thamnotettix pallidula n. sp. Ames.
Chlorotettix balli n. sp. Ames.
Alebra albotriella Fall. Ames.
Typhlocyba comes var. *ziczac* Walsh. Ames.
Typhlocyba querci Fh. Ames.
Typhlocyba rubrascula var. *bifasciata* O. & B. Ames. Berwick (Mally).
Typhlocyba lethierry Edw.
Typhlocyba rosea var. *commisuralis* Stal. Ames.

FAMILY CERCOPIDÆ.

- Philenus bilineatus* Say. Little Rock (Ball).

FAMILY FULGORIDÆ.

- Kelisia axialis* V. D. Ames.
Kelisia crocea V. D. Ames.
Liburnia osborni V. D. Ames and Fairfax.
Liburnia puella Van D. Ames.
Pentagramma vittatifrons. Uhl. Ames. Rare.
Laccocera vittatipennis Van D. Little Rock.
Pissonotus aphidioides Van D. Ames.
Pissonotus brunneus Van D. Ames.
Pissonotus marginatus Van D. Ames.
Pissonotus ater Van D. Ames.
Myndus impunctatus Fitch. Ames.
Peltonotus histrionicus Uhl. Little Rock.

*Description of new species included in the list are appended at end of list.

†Listed in the additions of previous papers as *Doratura minuta* on mistaken identification.

‡Heretofore listed as *Eutettix jucundus* Uhl.

FAMILY MEMBRACIDÆ.

Vanduzea vestita Godg. Ames, Little Rock, Sioux City, on *Petalostemon*.

Ophiderma flaviguttata Godg. Ames.

Heliria strombergi Godg. Ames.

Telamona pyramidata Uhl.

COQUILLETIA MIMETICA N. SP.

Ferruginous or ferruginous brown to fuscous. Females apterous, and simulating an ant. Male with very long wings and slender abdomen, ostea

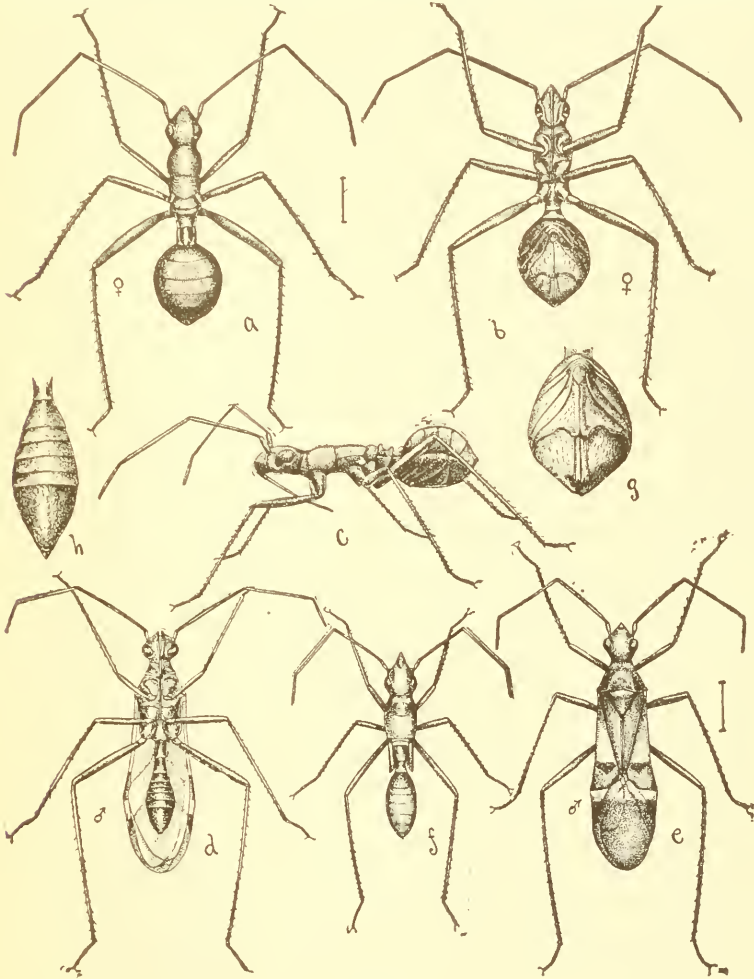


Fig. 15.

Coquilletia mimetica. a, female dorsal view. b, female dorsal view. c, female lateral view. d, male ventral view. e, male dorsal view. f, larva. g, female abdomen enlarged. h, male abdomen enlarged (From drawings by Miss King.)

curved, inflated, extended posteriorly, margin second abdominal segment white.

Length: female, 5.5 mm., male, 4.5 mm.: to tip of elytra, 6.5.

Apterous female. Head wider than pronotum, convexly narrowing to the pointed tylus, eyes moderately prominent, their outline conforming to the margins of the head; antennæ long, nearly equaling the length of body, first joint short, not passing the tylus; second joint longer than third and slightly thicker: fourth joint half as long as second, more slender than third, slightly curved; rostrum exceeding middle coxæ, first joint extending to border of buccula—remaining joints subequal, pronotum somewhat tumid, narrowed to form a collar in front, mesosternum slightly convex with marginal carinæ and slightly produced on metanotum; metanotum short, elevated laterally, carinate. Legs long, slender, coxæ strong. Abdomen with first two segments constricted to form a pedicel, the first one strongly elevated in a broad process in front and with an elevated posterior margin and the pleura forming a sharp lateral elevated carina or lamina, the second slightly wider behind, the lateral carinæ less prominent, remaining segments forming a globose, polished, minutely, sparsely haired body with conspicuous pleural fold, and elongate carinate sheath for the ovipositor. The ovipositor originates close to base of the globular portion of abdomen, the sternal parts of segments being extremely narrow and the sheath formed from the sixth, seventh, and eighth sternites.

Color brown, with the eyes, rostrum, apex of second joint and all of joints three and four of the antennæ, apex of tibiæ and the tarsi, fuscous or blackish. The globose portion of abdomen and dorsum of second segment are dark chestnut or piceous. The border of the ostea, a narrow posterior margin on first abdominal segment, the posterior border of second abdominal segment except the dorsum, light yellow or white.

Male. Head smaller, slightly more globose and eyes more prominent than in female. Pronotum widened at base, the sides nearly straight, the basal portion elevated and the posterior margin slightly concave. Scutellum large, swollen in front with a transverse area and an impressed line on the disc, the posterior portion carinate. Elytra broad, long, with a semi-transparent area at the basal half of the cuneus and another occupying basal part of cuneus; mesosternum large, polished, ostea large and curved internally, enlarged laterally and prominent. Legs slender. Abdomen very slender, pedicellate, polished, minutely pubescent, scarcely one-third width of elytra and extending about two thirds their length, the terminal ventral segment narrowing posteriorly, strongly curved upward, dorsally tubular, the claspers simple.

Color: Head, basal part of antennæ, anterior lobe of pronotum, scutellum, clavus, posterior half of corium, pectus, femora and part of tibia, and basal portion of abdomen testaceous or testaceo-ferruginous and polished except the rather ferruginous parts of elytra. Joints 2, 3, 4 of antennæ, apical portion of tibia, tarsi, cuneus except the base, and membrane of elytra blackish, apical portion of venter piceous. The basal transparent portion of elytra and a broad oblique band forming base of cuneus, the border and inflated exterior portion of ostea and posterior margin of second abdominal segment, white.

The larvæ are similar to the adults in color and form, but have the peculiar structure of the abdomen less marked.

This insect is of special interest inasmuch as we have as yet no winged form of female and only the winged form of the adult male. The apterous female form is remarkably ant-like in shape and appearance, as are in less degree the larvæ. They were at first supposed to be larvæ, but it was noticed that all the winged forms were adult males and an examination of all the wingless forms with the globose abdomen proved them to be mature females.

They have been found only on elevated grassy ridges and probably feed on some of the grasses, such as *Bouteloa*, which are common to prairie and plain.

An ant of an undetermined species and extremely like the female in appearance has been taken from the same locality.

In the figures the head is represented as raised on a level with the prothorax, but in pinned specimens and probably in the living individuals when not moving the head is bent downward and the prothorax curved on mesothorax, giving still more of an ant-like appearance.

Professor Uhler established the genus *Coquillettia* to include *insignis*, of which he remarks that only males have been seen. There can be little doubt that its female is also apterous, and on this account has escaped collection.

While possible that winged females may occur, it is evident that the apterous condition is the usual one.

SERICOPHANES OCELLATUS REUT.

This handsome little Capsid presents an interesting case of dimorphism and also of mimicry, the brachypterous female closely resembling an ant in the large pedicellæ globular abdomen.

Only the winged form, and presumably only the male, has hitherto been described, and that very briefly.

Brachypterous form.—Female: Ant-like the elytra reduced to rudiments reaching only to end of second abdominal segment. Abdomen from third segment globular. Head, thorax and abdomen polished. Length, 2.50 mm.

Head large, the space between the eyes equaling the pronotum in width; eyes large; antennæ moderately long, not longer than length of body; first joint thick, not reaching the end of tylus; second joint larger than third; fourth rather shorter than third; prothorax sub-globular, highly polished; scutellum broad, triangular; elytra reaching to or slightly upon the

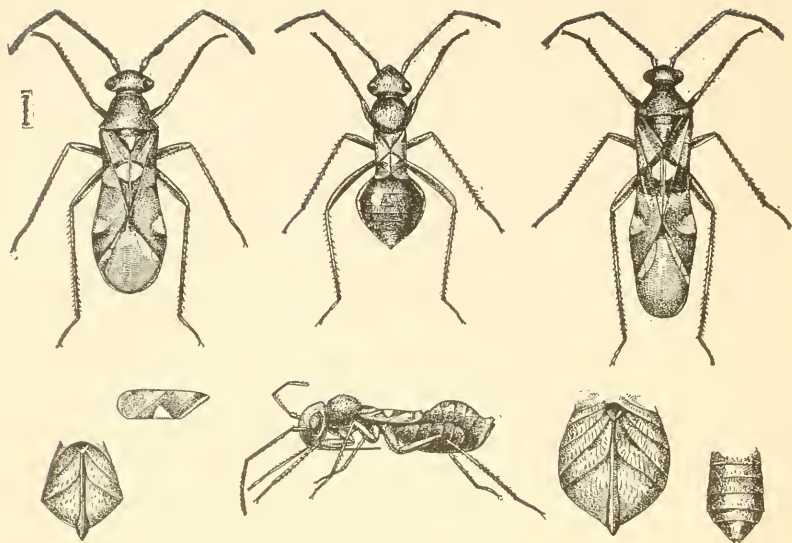


Fig. 16.

Sericophanes ocellatus. Dorsal views macropterous female at left, micropterous female in middle. Male at right. Below, ventral views of female abdomen macropterous at left, micropterous at right. Male extreme right.

globular portion of abdomen; wings wanting or very rudimentary; abdomen at base slender; joints three to eight forming a sub-globular, slightly flattened broad portion; a prominent pleural fold extending from the base to end of seventh segment.

Color: Head, thorax, elytra, base of abdomen, the second joint of antennae, femora, tibiae and base of tarsi reddish brown: first joint of antennae yellow; a bright yellow spot on elytra as in macropterous forms, apex of second joint and all of third and fourth, and tips of tarsi fuscous. Abdominal 4-7 segments black or pitchy brown entirely, beneath in two triangles, the apices of which nearly meet in the median line.

No brachypterous male has been observed.

Macropterous form.—Female: Similar to brachypterous form but with fully developed elytra and wings, a much less extended abdomen, and the pronotum widened at base with prominent angles. Length, 2.50, to tip of elytra, 3 mm.

Head smaller and with front less convex than in brachypterous form; antennae similar; prothorax much less tumid, narrower in front and widening posteriorly to form prominent humeral angles, and with the posterior margin overlapping scutellum and base of elytra; scutellum similar or a trifle larger; elytra broader and shorter than in males; the tip of corium not projecting as an obtuse angle; wings reaching to tip of elytra; abdomen slender at base, expanding to end of seventh segment, where they are almost as wide as the folded elytra, then contracting sharply to tip, flattened, the tip of ovipositor projecting.

Color the same as in the other forms, but in the specimens in hand the lower part of head and under surface of abdomen is somewhat suffused with rufous. The three powdery white bands on the elytra and the bright yellow across the clavus just back of the scutellum are very distinct. A spot each side of the central yellow ocellus and the cuneus are more golden brown than the rest of the elytra. The membrane is fuliginous except a transverse band at base and a narrow margin to the cuneus which are whitish transparent.

Male: More slender, darker, head smaller and eyes more prominent. Length 2 mm.; to tip of elytra 3.10 mm.

Head nearly vertical, eyes prominent, prothorax strongly declivous, widening to humeral angle; scutellum triangular, similar to female. Elytra long, narrower than in female and with the end of corium and base of cuneus forming an obtuse angle. Abdomen slender, flattened, the sides nearly parallel.

Color, dark brown or chestnut, the lower part of head a little lighter or tinged with rufous; the first and second joint of antennæ are yellowish and the spot on dorsum back of scutellum is light yellow; the elytra are chocolate brown with band inclosing the ocellate spot and the cuneus golden brown; three broken whitish or pruinose bands across the elytra, the point of scutellum and ocellate spot not quite reaching costal margin and the third at base of cuneus represented by a triangular patch next the costa; membrane as in the female; mesosternum piceous, polished, abdomen fuscous or blackish, yellowish-brown at base, polished.

Larvæ taken with adults present similar characters, but are quite remarkable in the greatly inflated terminal joint of the antennæ. The bodies are too much shriveled to permit of description.

The macropterous females were collected May 28th and June 7th, the brachypterous females May 22d, June 3d-7th and 12th, and July 31st, the males June 2d-7th and July 28-29th. Larvæ July 28th. This indicates a rapid development of the larvæ between the 1st of June and the latter part of July and probably two broods for the year, but no rearing of the larvæ or exact limitation of the broods has been attempted. They occur on grassy ridges in same location as preceding species.

The significance to be attached to the peculiar dimorphism and mimicry presented in this and the preceding species opens a question of too far reaching importance to be discussed here. That they resemble ants is certain, that they may by this resemblance gain some advantage is possible, but whether the abortion of the wings and elytra is merely the result of such mimicry or connected with advantages of an entirely different nature we are not prepared to guess. I have used the term mimicry in a general way to cover this feature of resemblance but I would dissent from the use of this term in such a loose manner if a better one were available. Such resemblances

seem to me not of necessity mimicry in its proper sense, or protective resemblance but merely the assumption of a similar form by different animals when adapting themselves to similar environments. The question readily broadens into a discussion of all the factors of adaptive evolution and while attractive is too large to attack in such a paper as this:

PARAMESUS STRAMINEUS N. SP.

Very similar to *P. twiningi* but of a light greenish-yellow color, the dark band of elytra absent and the lower half of face light yellow. Length to tip of elytra, female 5.50 mm., male 4.50 mm.

Vertex rounded at apex, one-half longer at middle than next eye, anterior two-fifths rising to form a distinct, elevated, angular margin. Front sinuate next antennæ then narrowing uniformly to base of clypeus; clypeus twice as long as wide, widening to apex; genæ sinuated below eye, scarcely angular laterally, reaching clypeus by a narrow line; loræ elongate, angular at ends, twice as long as wide, their lower ends not reaching clypeus by a considerable space. Pronotum minutely transversely rugulose on posterior two-thirds, evenly arcuate in front, scarcely concave behind and with a very shallow emargination near the middle, lateral margin short, with a distinct carina, humeral margin distinct, rather short, angles subprominent. Elytra with a few ramose nervures in clavus and between second sector and claval suture.

Color: Vertex, anterior two-fifths ivory white with two large, black, angular transverse spots near middle and a smaller, irregular, lineate fuscous one each side near eyes; the posterior two-thirds uniformly greenish-yellow or pallid with a longitudinal black impressed line at center. Face dark in upper half and light in lower; a conspicuous black line from eye to eye just below margin of vertex; front fuscous with light lines; clypeus light fuscous; genæ and loræ yellow, sutures black; pronotum greenish on disk and posteriorly with bluish tint; front, margin, and sides more yellowish, faintly mottled with irregular whitish maculations; scutellum ochre yellow with whitish triangle on lateral margins and at tip, and a faint fuscous line separating the usual areas; elytra hyaline or pellucid with the few ramose lines, a spot in the second, third and fourth apical, the middle and inner anteapical cells, and an apical submargin, fuscous; apex of clavus and costal transverse nervures dark fuscous or black; beneath light yellow spotted and lined with black; tergum black with yellow maculate margin.

Genitalia: Female, ultimate ventral segment long, posterior margin broadly, shallowly excavated and bearing at center a ligulate process about as long as wide and minutely notched at tip, pygofer posteriorly set with minute remote short gray hairs arising from black points; male, valve very short, scarcely visible; plates elongate triangular, reaching to tips of pygofer, margins with a few hairs.

Described from five females and one male. Of the females two were collected at Sioux City, July 7th, one at Sioux Falls, S. D., July 4th, and one at Ames, June 15th; and one collected

at West Point, Neb. in June has been sent to me by Professor Bruner. The male was collected by Mr. Ball at Little Rock, Iowa, July 2d.

While this form is strikingly like *twingi* in general characters the very marked difference in color, the absence of black bands on the elytra, and the differently colored face cannot fail to distinguish it, and until intermediate forms are found or it can be proven by life-history details that they intermingle it must stand as distinct. It evidently belongs to the plains fauna and probably feeds upon some of the Compositæ.

SCAPHOIDEUS OCHRACEUS N. SP.

In size and color resembling *jucundus* but in venation like *intricatus* or *luteolus*. Tawny ochraceous and pallid with most of the elytral nervures fuscous. Length to tip of elytra, female 6 mm., male 5 mm.

Vertex as long as width between the eyes, nearly as long as pronotum, the margin angularly rounded; front, narrow; margins slightly concave next the antennæ, tapering uniformly to base of clypeus, which it equals in width. Clypeus twice as long as width at base, broadening to the apex, which is distinctly truncate; loræ oval, sub-angulate at tips, twice as long as wide; genæ broad, slightly concave below eyes and sub-angulate on margin forming a narrow margin below loræ.

Elytra with the first two reflexed costal veinlets very oblique, as in *immistus*, the first originating at or just in front of the transverse veinlet; the second near the middle of the outer anteapical cell; the third at the end of the anteapical cell but not touching the apical veinlet. In one specimen an extra oblique vein occurs between first and second.

Color: Vertex yellow with a broad ochraceous or ochraceous-rufus band across the disk, the median portion forming a short curve and reaching the width of the band toward the apex, sometimes almost interrupted; the anterior border with a fuscous line broader, fainter, and broken at the apex; front yellow with two black or fuscous lines running nearly from eye to eye, and three or four short broken arcs becoming obsolete toward the middle; a small fuscous spot on genæ below the insertion of the antennæ; pronotum with two large spots on the anterior margin near the middle; the posterior half, except narrow median line, two large lateral spots and a slightly fainter median stripe, a wide border to nearly all the nervures and the apex of elytra, ochraceous; a spot at end of inner claval nerve, a short line at end of outer claval nerve, an elongate spot at end of clavus, a spot in inner discal area, interrupted lines on the nervures most conspicuous on the reflexed veinlets and next the costa and a sub-apical border, fuscous; the elytral cells whitish hyaline; below light yellow and pallid; the posterior border ultimate ventral segment female, terminal bristles on pygofers; a series of points and terminal annulus on tibia, tip of first joint and all of second joint of tarsus, deep fuscous or black.

Genitalia: Female, ultimate ventral segment long, the posterior border straight or very slightly produced at the middle. Pygofers full, polished,

with marginal and terminal bristles, the latter strong; male, valve very short, transverse; plates broad, roundly narrowing to obtuse tip with weak marginal bristles; pygofer rather broad, extending half their length beyond the plates and set with long, stiff bristles.

Described from twelve females and seven males collected at Ames from July 29th to August 13th.

While this species has the general color of *jucundus* it differs from that species very distinctly in the oblique reflexed veinlets and in having the transverse band on the vertex instead of the two parallel spots. From *immistus*, *intricatus* and *luteolus*, which it resembles in venation, it differs in color and size.

SCAPHOIDEUS PICTURATUS N. SP.

Color pattern very similar to *sanctus*. Head more sharply angular, reflexed veins less oblique or indistinct. Length to tips of elytra, female 5 mm., male 4 mm.

Vertex sharply angulate at the tip, as long as width between eyes, and nearly twice as long at middle as next eye. Front very slightly widening next antennæ, tapering uniformly to base of clypeus; clypeus with sides parallel, base and apex convex; lore small, suboval; genæ roundly angulate below the eyes. Pronotum sharply arcuate in front, truncate behind, lateral margin extremely short; scutellum small, the elytra with the post-nodal veinlets irregular, the first either absent or not reflexed, the second strongly reflexed, the middle and inner anteapical cells with distinct or obsolete cross nervures.

Color: Vertex, anterior part of pronotum, scutellum, face, pectus, venter and margin of abdomen above, yellow or greenish-yellow; two minute points next each eye, two short oblique lines near tip, and a very slender median line on vertex, three or four strongly curved arcs on the front, the margins of the olivaceous areas, an oblique band near the tip, and a submarginal border on the elytra, fuscous. The elytra are fusco-olivaceous, interrupted with ivory white as follows; a broad oblique band on the base of corium and clavus paralleling the sides of the scutellum, a discal spot at forking of the first sector, a commissural spot and a broad band across the base of the anteapical cells. The nervures are white on the white portions and also in the fuscous part at apex.

Genitalia: Female, ultimate ventral segment short, slightly notched on the median line; pygofer thickly set towards tip with rather fine bristles; male, valve small, plates long, tapering gradually to the obtuse tip, exceeding the short pygofer. Both plates and pygofer are finely ciliate with pale hairs.

Described from one female received from Prof. H. Garman, Lexington, Ky., and one male which I collected at Burlington, September 5, 1897.

While this appears superficially to resemble *sanctus*, the different venation and the different markings on the vertex as

well as the very different genitalia renders it easily separated from that species. In venation it approaches *Deltocephalus* and adds another link to the chain connecting the two genera.

THAMNOTETTIX CILIATA N. SP.

Green or yellowish-green, the under part of thorax and nearly all of abdomen black. Head with four quadrate black spots on margin between eyes and two on the vertex behind the outer ones. Length to tip of elytra, female 5.50 mm., male 5 mm.

Vertex subangulate in front, about one-half longer in middle than next eye. Front tapering evenly to the broad apex, apical angles rounded; clypeus widening but slightly to the truncate tip, nearly twice as long as wide; loræ large, nearly reaching tip of clypeus, genæ broad, sides rounding reaching the clypeus by a narrow line. Pronotum one-third longer than vertex, slightly emarginate posteriorly, humeral margins long, lateral margins short, rounded; elytra long, narrowed, the nervures distinct, becoming fainter near costa towards apex.

Color: Head yellow with a conspicuous transverse row of four quadrate black spots on margin of vertex extending down on to the front, two small approximate spots or lines on the disk about half way from occiput to tip, variable in size and a spot on each side near the eye parallel to the outer marginal spot, in some cases reduced to a round dot. A spot at base of antennæ, four or five interrupted arcs on front, and frontal sutures, black; sometimes spots of black on genæ and loræ and an annulus on second joint of antennæ, in female, black. Pronotum, greenish transparent, with anterior border more yellow; scutellum yellow; elytra greenish hyaline or flavescent, the nervures yellowish or whitish and in the females usually bordered with fuscous. Tergum black except margin and part of terminal segment yellow; pectus and venter black, lateral margins, posterior margins of base and side margins of ultimate ventral segment, a narrow posterior border to the segments and the pygofer of female, and usually plates and pygofer of male, yellow or whitish.

Genitalia: Female, ultimate ventral segment slightly longer than penultimate, minutely rugulose; posterior margin scarcely concave; pygofer large, slightly exceeded by the ovipositor and set with stiff grayish bristles, those at apex stronger and darker; male, valve long, nearly as long as wide, posterior border convex; plates short, divaricate, obtuse or truncate, and bearing a few stiff hairs on disk and a dense brush of long white ciliate hairs from the margin; pygofer long, exceeding plates, obliquely truncate obtuse at tip, their margins set with a series of stiff hairs.

Described from numerous examples of both sexes collected in Iowa and one female from Colorado (Gillette). Adults at Ames from June 2d to July 2d, and from August 27th to October 9th. Three specimens from Little Rock July 2d (Ball), and two from Algona, Iowa, May 9th (Mally).

This species presents many striking resemblances to *smithi*; in fact, specimens of *smithi* having the frontal black band inter-

rupted are scarcely distinguishable except by form of clypeus. Usually, however, *smithi* has a broad, unbroken band, without any traces of spots on the vertex, but with the border of loræ next clypeus with a broad black line, exaggerating the width of clypeus, while *ciliata* seldom or never has the quadrate spots of the frontal band coalesced, and the loræ, while sometimes slightly spotted with black, lack the line next the clypeus.

The greater length and narrower tip of the clypeus, and the broader, more truncate, male plates are the decisive structural characters.

THAMNOTETTIX CYPERACEUS N. SP.

Resembles *melanogaster* but larger and usually more deeply colored, and with three parallel croceus stripes on head and pronotum. Length to tip of elytra, female, 6 mm.; male, 5.25 mm.

Vertex nearly twice as wide on the middle as next the eye, angulate at tip, the margin sharply angular, front narrowing evenly to clypeus, scarcely emarginate next antennæ; clypeus slightly widened and more nearly truncate at the apex; genæ evenly rounded. Pronotum long, about one-half longer than vertex, slightly concave behind, lateral and humeral angles rounded. Elytra long, the nervures distinct, claval nervures parallel.

Color: A broad stripe and a narrower median one on the head; pronotum and scutellum tawny, alternating with yellow. Ocelli red. Four transversely linear spots just below the margin of the vertex (not, or scarcely visible, from above) the insertion of antennæ and the lateral margins of front, dorsum of abdomen except margin and terminal segment, disk of venter and ovipositor black. Elytra tawny hyaline with whitish nervures. Margin of abdominal segments yellow or tinged with rufous posteriorly.

Genitalia: Female, ultimate ventral segment scarcely longer than penultimate, very slightly emarginate on either side of the middle of posterior border. Male, valve produced, large, and rounded posteriorly, with a median impressed line at the tip; plates short, obtuse, and thick at the apex, with dense tufts of hairs and a conspicuous bristle arising from extreme tip; pygofers short, hairy.

Described from four males and four females collected from *Carex* at Ames, Iowa, October 6, 1897. In the disposition of black markings this species almost duplicates *melanogaster*, but it is much larger, the male genitalia are quite different, and other characters will easily separate them.

THAMNOTETTIX PALLIDULA N. SP.

Smaller and lighter colored than *melanogaster* and with the under surface pallid. Approaches *fitchi* but markings are less distinct. Six points in a line across the front part of vertex, either all black or part or all of them faint or obsolete. Length to tip of elytra, 4 mm.

Vertex one-third longer on middle than next eye, very obtusely and roundly angulate, the margin rounded; front narrowing rapidly from antennæ to clypeus; clypeus nearly twice as long as broad, scarcely widening at apex; loræ small, oval; genæ broad, distinctly angular. Pronotum strongly curved anteriorly, posterior border straight, lateral margins very short. Elytra long and narrow, nervures distinct.

Color: Vertex, pronotum and scutellum light yellow with faint ochraceous stripes, the two median ones extending to margin of vertex and diverging posteriorly to cover the lateral angles of the scutellum, the outer ones on pronotum only. Across the front of the vertex a row of six dots, the inner ones behind the margin the outer ones directly on the margin in front of the eyes, all black or the inner ones fainter or obsolete, but those next the eyes are black in all but one of the specimens in hand. The elytra are flavescent or faintly cuprescent with the nervures conspicuously whitish. Beneath, entirely pallid, except the median posterior part of the ultimate ventral segment in female, bordering the notch laterally, and exposed edges of ovipositor, light fuscous. Venter and margins of dorsum in male sometimes more decidedly yellow.

Genitalia: Female, ultimate ventral segment short, the posterior margin produced each side of a median broad and deep notch, the median portion of which is straight or scarcely produced into a very obtuse tooth pygofer set with stiff hairs on the posterior portion; male, valve, anterior margin convex, posterior margin straight; plates triangular, outer margin slightly convex and sparsely ciliated; points acute; pygofer exceeding the plates, obliquely sinuate, acute at tip and bearing rather strong hairs.

Described from eight females and four males collected at Ames, Iowa, by Mr. E. D. Ball.

This species is quite similar to *fitchi* in size but is more yellow in color and the genitalia are quite distinct.

CHLOROTETTIX BALLI N. SP.

Resembling *unicolor* and *spatulatus* but more yellowish-green and with the vertex subangulate. Ultimate ventral segment female with a spatulate process.

Length to tip of elytra, female, 7-7.25 mm., male, 7 mm.

Vertex one-half longer on the middle than next the eyes, subangulate; front narrowing in almost straight lines to the clypeus; clypeus broader and shorter than in *spatulatus*, base and tip slightly convex, sides parallel. Pronotum strongly emarginate behind. Elytra entirely hyaline, the veins indistinct.

Color yellowish-green. Head and thorax usually darker green, the tip of vertex, margin of venter, and dorsum of abdomen in most specimens suffused with ochreous.

Genitalia: Female, ultimate ventral segment long and with a deep notch extending to near the base and including a spatulate process as in *spatulatus*. The notch is deeper and wider and more open at the base of the spatulate process, the process is broader and reaches only half way to the tips of the sub-acute lateral margins of the segment; male, valve large,

longer than in *spatulatus*; plates narrowing rapidly behind the middle, the tips upturned, divaricate and scarcely acute; a row of bristles along the outer margin, few in numbers, set in a uniform series and a few minute cilia at the extreme tips; pygofers long, exceeding plates, pointed at tip.

Described from eleven females and four males, collected at Ames, Iowa, July 4th-11th-29th, and August 3, 1896.

Except for the more yellow color and the different shape of the vertex this species resembles very closely the *spatulatus*, but there is a distinct difference in the genitalia, notwithstanding the presence of the spatulate process which is so far known only in these two species. Two males which are otherwise apparently identical with the above have the plates passing the pygofers much more acutely pointed, and the elytra distinctly infuscated at tip. It seems hardly possible that they can belong with this species, but no females agreeing with them have been seen. Dedicated to Mr. E. D. Ball.

PHLEPSIUS LOBATUS N. SP.

Color and shape of *truncatus* but slightly smaller. The female ultimate ventral segment produced at sides into a distinct obtuse lobe. Length to tip of elytra, female, 5.75 mm ; male, 5.50 mm

Head as wide as pronotum; vertex about one-third longer on middle than next eye (slightly fuller in male than in female). Front almost as wide between the eyes as length, narrowing rapidly to the apex, the margins from antennae to apex straight. Clypeus narrowed at the base, truncate at apex; lorae large, the frontal angles sharp; genae rounding regularly from the sinuation below the eye. Pronotum with the posterior portion distinctly concave; scutellum broad, with a sharply impressed line on the disk.

Color: Above, gray from the finely irrorate and lineated white and fuscous markings. Front dark fuscous in upper part, becoming lighter below; pectus, venter and legs whitish with fuscous maculations and points.

Genitalia: Female, ultimate ventral segment very long, depressed laterally and produced into marginal lobes, between which the posterior border is convex, the central portion elevated, becoming carinate and minutely notched at posterior border. Male, valve triangular, plates rather narrow, tapering uniformly from base to sub-acute apex.

Described from one male and one female collected at Little Rock, Iowa, July 2, 1897, by Mr. E. D. Ball, and one female at Ames, Iowa, September, 18th.

This might easily be mistaken for *truncatus*, or even for a small *irroratus*, but the genitalia are strikingly different.



